10439/B

5842

H.xxvi.w
18

ESSAYS

ON

SEVERAL IMPORTANT SUBJECTS

IN

SURGERY.

43067

ESSAYS
ON
SEVERAL IMPORTANT SUBJECTS
IN
SURGERY:

Chiefly on the Nature and Cure of FRACTURES
of the long Bones of the Extremities, particularly thoſe
of the Thigh and Leg, whether ſimple or compound;
for which A NEW METHOD of RETENTION is propoſed.

The whole illuſtrated with COPPER-PLATES.

BY

JOHN AITKEN, Surgeon,

Of the College and Incorporation of Surgeons
in Edinburgh.

Ad utilitatem vitæ, omnia conſilia, factaque noſtra dirigenda ſunt. Tacit.
Res, ætas, uſus, ſemper aliquid adportat novi. Terent.

LONDON:

Printed for E. and C. Dilly in the Poultry; and
A. Kincaid and W. Creech, J. Balfour, W.
Drummond, and J. Bell, Edinburgh.

M,DCC,LXXI.

Entered in Stationers Hall.

WELLCOME
HISTORICAL
MEDICAL
LIBRARY

TO

DR ALEXANDER MONRO,

PHYSICIAN AND PROFESSOR

OF

MEDICINE AND ANATOMY

IN THE

UNIVERSITY OF EDINBURGH,

OF

ABILITIES AND REPUTATION

IN HIS PROFESSION,

FAR TOO EMINENT FOR A PARTICULAR

ENCOMIUM IN THIS PLACE;

THE FOLLOWING ESSAYS

ARE MOST RESPECTFULLY

INSCRIBED,

BY

THE AUTHOR.

PREFACE.

THAT the following pages (which are preſented to the public eye with the greateſt diffidence, and of whoſe imperfections none can be more ſenſible than the Author) might be more generally uſeful, eſpecially to the young Surgeon; and that their utility might not altogether depend on any thing which the Author might be inclined fondly to deem new or important;—he has attempted to exhibit a ſhort or elementary view of the general doctrine of fractures, both as to their nature and treatment; in which he hopes nothing material is omitted.

For the preliminary pathological and phyſiological remarks, he has generally quoted his authorities; and will never diſpute much with any one about them.

Although many great and illuſtrious Surgeons, ancient as well as modern, have very much laboured this ſubject; ſtill it is ſurely very far from having attained to that degree of improvement of which it is ſuſceptible. That it is very much promoted, far leſs exhauſted, by the preſent attempt, the Author has not the vanity once to imagine. He, however, humbly hopes, that, provided the methods propoſed for effecting retention of fractures of the thigh and leg bones, whether ſimple or compound, on fair and candid trial, recommend themſelves as much to the experience of others as to his; his feeble efforts towards improving a branch of an art, allowed by all to be highly important and uſeful, and of which he has long been peculiarly fond,—will not be altogether deſtitute of general uſefulneſs.

The proſecution of the ſame principle, upon which the method propoſed for accompliſhing retention of the fragments of the thigh and leg bones, is founded,—naturally ſuggeſted the ſubjects of the other eſſays, (that on teeth-drawing excepted)· In theſe the author has ventured to make ſome propoſals, which, as yet, he has not had an opportunity really to put in practice; however, they are only mentioned as probable and rational,—to ſtand or fall by the only infallible teſt, candid experiment.

The Author declines particularly to mention the approbation which Gentlemen, not of the loweſt rank in their profeſſion, have beſtowed on ſome of what he calls improvements: as he is altogether perſuaded, that no authority, however great (that of a Monro not excepted), is ſufficient long to ſupport any pretenſions to improvement, however ſpecious, unleſs founded on experience and utility; and ſuch as are ſo,

Tali auxilio—non egent.

To thoſe who are of opinion (if any ſuch there be), that none whoſe locks are not ſilvered over wit hage, ſhould venture to commence author,—the words of *Quintilian* ſhall be an apology, as well for the Author as for his performance.

“ Quæ præſenti opuſculo deſunt, ſuppleat ætas; non enim differendum eſt tyrocinium in ſenectutem. Nam quotidie creſcit metus, majuſque fit ſemper quod auſuri ſumus: et dum deliberamus quando incipiendum, incipere jam ſerum fit. Quare fructum ſtudiorum viridem, et adhuc dulcem, promi decet; dum et venia et ſpes eſt, et paratus favor, et audere non dedecet.

CONTENTS.

Of FRACTURES *in general.*

Introduction, 17
Definition of Fracture, 20
Of the Coheſion of the oſſeous matter, 22
Rigidity of the bones, 24
Tenacity of the bones, 28
Oil or Medulla *of the bones,* 32
Of Cauſes inducing fragility, or predispoſing to Fractures of the bones, 34
Of the Nature and Formation of Callus, 40
Of the Symptoms of Fractures, with their Rationalia, 46

Of the Prognoſis *of Fractures,* 52

Of the Method of Cure, or Treatment of Fractures, 56

Extenſion, 57

Coaptation, 64

Retention, 65

Deligation, 70

Poſture, 76

Of Fractures of the Thigh-bone, 85

Of Fractures of the leg-bones, 124

Of Conveying Fracture-patients from one place to another, 133

Of Fractures of the Tendo-Achillis, 141

Of Retraction of the Skin and muſcular parts, after Amputation of the lower extremities, 157

1. *Of the Croſs-ſtitch,* 157

2. *Of the Flap-operation,* 174

Of

Of reſtraining hæmorrhage after Amputation of the lower extremities by topical Compreſſions, 177

Of Fractures of the Patella, 185

Of extracting Teeth. 196

Of

Of FRACTURES in general.

INTRODUCTION.

THE bones are the hardeſt, moſt ſolid, and leaſt flexible parts of the animal body *; conſtituting, as it were, the *fundamina* of the whole œconomy; at once imparting firmneſs and ſtability to the wonderful fabric.

As ſervices ſo important, and ſo eſſential to all the functions, are thus performed by the bones, eſpecially by thoſe of the limbs; for the moſt evi-

---

* Prof. Monro's Oſteology. p. 6.

Os eſt pars noſtri corporis duriſſima, ſicciſſima, et flecti minime apta. Commer. literar. Noremberg Vol. ix. p. 354.

dent reaſons it follows, that their diſeaſes in general, and *fractures* in particular, muſt be productive of diſorders very intereſting to the whole frame.

To conduct the cure of the various fractures, therefore, with propriety, at the ſame time reſtoring and preſerving, as much as poſſible, the beauty and natural form of the human figure,—has ever been regarded as no inferior department of the Surgeon's art.

In the greateſt part of the following pages, are preſented ſome remarks on the treatment and cure of fractures; chiefly as happening to the long bones of the extremities.

Although the idea meant to be conveyed by the term *fracture*, thus employed to mark a diſeaſe of the bones, may ſeem very familiar, and abundantly comprehenſible even to the youngeſt tyro in ſurgery; yet, previous to any obſervations on the treatment of this diſeaſe, for his amuſement at leaſt, if not inſtruction, it was judged no way improper to offer a definition of this term; and alſo, to ſubjoin a few curſory phyſiological and pathological remarks on ſome conditions and circumſtances of the bones which appear to have a connection with this ſubject, and an acquaintance with which may ſometimes not a little influence the Surgeon in forming a juſt *prognoſis;* and, what is of much greater conſequence, in adopting a proper method of cure.

DEFINITION *of* FRACTURE.

" A SEPARATION of the parts of a bone, by violence, from their coheſion, into large portions or fragments*," is the conciſe, tho' accurate and comprehenſive definition of a fractured bone, given by the truly illuſtrious Dr CULLEN, our eſteemed Preceptor; which I readily adopt,—for who can give a better one?

IF a power act on any piece of matter, with force ſufficient to ſeparate or diſtract its component particles beyond that degree of contact which is neceſſary to their coheſion; it is evident that a diviſion of ſuch piece of matter into two or more portions muſt unavoidably enſue[*].

---

* Oſſis partes a cohaeſione in magna fragmenta vi ſolutae. Culleni Gener. Morb. Gen. cxxxi.

Oſſis ſubſtantiae vi externa ſoluta unitas facta.—Commer. literar Norimberg. loco citat.

When an animal body is thus acted upon by ſuch a power, a violent ſeparation, diviſion, or ſolution of the continuity of its ſubſtance, will in like manner be effected.—According as the texture of the part ſo divided is more or leſs compact, the diviſion has obtained various names from Pathologiſts. Thus, if a ſoft part is divided, they call it *Rupture*, *Laceration*, *Wound*, *&c.* If a part of more compact texture, as a bone or tendon, it is called *Fracture* [†].

That the coheſion of the particles of bones is the reſiſtance to be overcome by fracturing powers, is obvious from the definition; and that according

---

[*] Cum ablata (*vel deſtructa*) cohaeſio concipiatur, ſolidi idea evaneſcit.—Illuſt. Gaub. Pathol. Sect. 152.

[†] Illuſt. Gaub. Pathol. Sect. 217.

ing to the degree of this coheſion ſuch powers will, with more or leſs facility, effect the diviſion of the bones, is equally obvious.

Of the Coheſion of the oſſeous Matter.

THE coheſion of matter in general is, that affection of it whereby, in conſequence of nature's univerſal law, Attraction, its component particles are determined to cohere and to form maſſes; whoſe magnitudes are more or leſs great, according to circumſtances. The coheſion, then, of the oſſeous matter, is naturally referable to the energy of this ſo general law over it.

ALTHO' the abſolute coheſion of the particles of the bones of old animals, appears to be conſiderably greater than that of thoſe of younger ones*; yet, to the moſt common cauſe inducing fracture, thoſe of the former are found, by experience, to be far more fragile than thoſe of the latter *.

---

* Prof. Monro's Oſteol. p. 53.

THIS difference ſo remarkable between theſe two conditions of the bones, is perhaps to be intirely aſcribed to ſome degree of *pliancy* or *tenacity* which the bones of young animals poſſeſs, and of which they are afterwards deprived by age. On what this circumſtance depends, will be inquired into hereafter.

IN conſequence of this pliancy or tenacity, young bones are qualified to yield conſiderably to the action of a *vis percutiens*, ſuch as that of a ſtroke by or againſt any hard body, (which is a very common cauſe of fracture) and thus better enabled to elude its fracturing power, than the more rigid and more firmly cohering old bones,—altho' theſe latter would probably give moſt reſiſtance to a *vis diſtrahens.*

---

* Tanto levioribus cauſis fractura naſcitur quo oſſa ex ſenio, &c. fragiliora ſunt.—Illuſt. Gaub. Pathol. Sect. 217.

See notes in page 25.

Of the Rigidity of the BONES.

ACCORDING to ſome Philoſophers, it is only neceſſary that the ſimple homogeneous particles of matter be brought into contact, and the firmeſt poſſible coheſion will be thereby formed, or they will be mutually very ſtrongly attracted, and form a maſs perfectly ſolid.

FROM this doctrine, it is a very evident conſequence,—that the more the proportion of the earthy particles in bones is increaſed to that of their other component parts, theſe earthy particles will approach the nearer to one another, or be mutually attracted with greater power, and conſequently cohere more firmly. In this manner, it would ſeem, is generated that quality of bones which is known by the term *Rigidity*; and to which their fragility is always in proportion*.

FROM the firſt moment of concepti-

---

* Cohaeſionem *intractabilem* terra mera facit. Sufficit huic proximus ſuarum particularum contactus ad cohaerendum: alienorum interventus cohaeſionem modo attemperat; quae tanto laxior eſt, quo iſtarum ad terram major ratio.

Conſtat, partium humani corporis materiaturam ubique eandem eſſe, elementa eadem, differentiam vero horum proportioni deberi. Abundans ſiccum (*vel terra*) firmitatem (*vel rigiditatem*) effecit.—— Gaub. Pathol. Sect. 143-146.

In univerſo corpore portio elementi terrei augetur, unde oſſium fragilitas increſcit. —— Haller Prim. lin. Phyſiol.. Sect. DCCCCLXVIII.

on, to the utmoſt verge of life, by the gradual accumulation of earthy matter,—the proceſs to rigidity is conſtantly advancing, not only in the bony, but alſo in the ſofter parts of all animal bodies. To this change is chiefly, and perhaps ſolely, to be attributed the very remarkable diminution of irritability and vaſcular texture, which is obſerved to take place in all aged animals: All the parts of their bodies thus approaching, as it were, to ſolidity.

PARTS naturally ſoft have now become bony; while the bones themſelves have acquired a ſurpriſing degree of hardneſs and ſolidity, conſiſting almoſt totally of perfect earth*. In this way, it is that animation, of neceſſity, and as it were ſpontaneouſly terminates; or death, merely from age, follows; when, in a moſt literal ſenſe, "Duſt returns to duſt."

---

* Profeſ. Monro's Oſteol. p. 17.
Haller Prim. lin. Phyſiol. Sect. DCCCCLXVIII.—lxxii.

Commer. literar. Norimb. vol. ix. p. 354.

This great accumulation of the earthy principle in bones, would ſeem to be the cauſe producing that extreme rigidity and fragility, which thoſe of very old people are obſerved to poſſeſs. To the almoſt total abolition of their vaſcular ſtructure, may, perhaps, in a great meaſure, be imputed the tedious formation, and ſometimes abſolute defect, of *callus*, obſervable in the fractured bones of ſuch people.

From the above obſervations, the reaſon will in part be abundantly evident,—why the bones of old animals, or thoſe in the condition now deſcribed, are fractured with greater facility, from equal cauſes, than thoſe of younger ones.

Of the Tenacity of the BONES.

IT has been taken notice of above, that the quality of tenacity is more prevalent in young than in old bones; communicating to the former the pliancy, which, in a degree much ſuperior to the latter, they are found to poſſeſs. It remains, therefore, to inveſtigate what may moſt probably be the reaſon of this difference between theſe two ſtates of the bones.

IN the very young *fœtus*, the rudiments of the future bones are diſcovered, by diſſection, altogether to conſiſt of a *mucus*; which next aſſumes the appearance of a tranſparent jelly or gluten*.

Among this gluten, which ſeems to be analogous to, or the ſame with, the coagulable part of the animal fluids, the earthy principle or oſſeous matter is determined to collect, and to form incipient oſſifications; or, as Anatomiſts chuſe to ſpeak, *Nuclei*†.

The wonderful determination of the oſſeous matter to thoſe parts of the embryo only, which the neceſſities of the œconomy require to be rigid and bony, by the operation of the omnific hand of nature's Architect; like every other circumſtance in our formation, cannot fail to ſuggeſt delightful reflections to the contemplative mind.

---

* Omnino tenerorum foetuum oſſa merum ſunt gluten; fluidum primo, inde collae ſimile. Haller. phyſiolog. Prof. Monro's Oſteology. p. 32.

† Haller. prim. lin. phyſiolog. Sect. DCCCCXV. 19.

Precisely in the ſame proportion as this oſſifying proceſs advances, the original gluten and vaſcular ſtructure of the bones are extinguiſhed;—for this reaſon it chiefly is, that, in very aged animals, they are found to have become extremely brittle, and to have acquired an almoſt flinty hardneſs.

As young bones, at the ſame time that they poſſeſs a greater degree of tenacity than old ones, are obſerved to abound with a remarkably greater quantity of this gluten; and as whatever has power to diminiſh the quantity of their gluten, or to alter and vitiate its nature, (which, as will be mentioned hereafter, many diſeaſes have) alſo diminiſhes, at the ſame time, their tenacity, or increaſes their fragility: It appears highly probable, that this quality depends almoſt entirely on the gluten, and is very much influenced both by its ſtate and quantity; and that the ſuperior tenacity of young bones may juſtly be aſcribed to the ſuperior quantity of this gluten interpoſed betwixt the earthy or oſſeous particles in their compoſition, which, by experiment, is found really to be the caſe*.

THE greateſt reſiſtance which the bones can oppoſe to fracturing powers ſeems not to reſult, either from the qualities of tenacity, or rigidity ſingly conſidered, but from a certain combination of both; and this may juſtly be preſumed to be moſt compleat at that period of life when every other part of the ſyſtem is fully evolved and in greateſt perfection, viz. at Puberty.

---

* Gluten terreas partes aduniens et firmans, baſeos ergo locum praebet *tenacitati* oſſium, et impedimento eſt; quo minus evadant arida et fragilia. —Hoc quoque videre licet in oſſibus calcinatis, quae ſaepius ſolo contactu digitorum diffringuntur, et in pulverem fatiſcunt.

Quo plures partes oleoſae, aquoſae, et ſalinae (*which, according to this Author, conſtitute the gluten*) adſunt in ſubſtantia oſſis, eo firmior eſt ejus cohaeſio, (*according to us, eo major eſt ejus tenacitas*), et vice verſa.—Commer. literar. Noremberg. Vol. ix. p. 354.

Of the Oil, or Medulla *of the* BONES.

AFTER the ſyſtem has reached its ſummit of increment, the gluten of the bones would appear to be much diminiſhed*; but the equable diſtribution of the oily or medullary particles, every where in their ſubſtance†, which now takes place, muſt contribute very much to preſerve their tenacity; or to ward off fragility, and the other conſequences of age, much longer than would otherwiſe happen. After this period, therefore, the reſiſtance which the bones make to fracturing powers, they owe in no ſmall degree to the general diſtribution of this oil through their ſubſtance; and this is doubtleſs a chief purpoſe for which ſo much of it is collected within all the bones.

---

* Senium gelatinam minuit. —Haller. prim. lin. Phyſiolog. Sect. CL.

† Prof. Monro's Oſteol. p. 21.

In the bones of very young animals this oil is found only in ſmall quantity, and is very imperfect in its nature; but in thoſe of ſuch as are grown up, it is much more abundant and pure; as if Nature, by this means, intended to counter-balance the gradual diminution of their glutinous part.

By great age even this oil is either totally waſted, or remains only in very ſmall quantity. This circumſtance enables us to underſtand the reaſon, why the bones of very old people are ſo extremely brittle; and why their reunion, if they admit of any, muſt be very tedious*.

Of Cauſes inducing Fragility, or prediſpoſing to Fracture, of the BONES.

It muſt be confeſſed, that the cauſes immediately occaſional of fracture, very often act with ſuch irreſiſtible violence and impetuoſity, that were the bones much ſtronger than they naturally are, they muſt inſtantly be divided; independently of any pre-diſpoſition whatever, or without the concurrence of any of the pre-diſpoſing circumſtances after mentioned. Nothing is however more true, than that the natural fragility of the bones is, from certain morbid *diatheſes* or conditions of the general habit, very much increaſed: for this reaſon they are more expoſed to fracture, and when broken, their cure, or the reunion of their fragments, is found to be always tedious in proportion to the prevalence of ſuch *diatheſes*.

---

* Senibus oſſa facilius franguntur quam junioribus, quoniam oſſa juniorum plus aquoſae pinguedinis poſſident; hinc mitiora ſunt, et vi externae facilius cedunt; quum contra in ſenioribus pinguedo ſenſim ſenſimque evaneſcit, hinc oſſa duriora et fragiliora evadunt.—Commer. literar. Norimberg. Vol. ix. p. 354.

ATTENTION to this circumſtance is of no ſmall importance in practice; and is a chief reaſon why ſome of the morbid ſtates of the ſyſtem, reckoned peculiarly productive of this fragility or pre-diſpoſition to fracture, are enumerated below.

It has already been remarked, that the tenacity of the bones, ſo inſtrumental in reſiſting the action of fracturing powers, depends greatly, or perhaps intirely, on the ſtate and quantity of their *gluten* and medullary oil. If this doctrine is well founded, it may be concluded,—that the diſeaſes which have a tendency to vitiate, diminiſh, or deſtroy theſe component parts of the bones, muſt, at the ſame time, and in the ſame degree, induce fragility pre-diſpoſing to fracture.

The diſeaſes or morbid *diatheſes* of the general habit here principally alluded to, are characteriſed by pathological writers under the following heads, *viz.* the *ſiphylitic* or *venereal*, the *putreſcent* or *ſcorbutic*, the *arthritic* or *gouty*, the *ſtrumous* or *ſcrophulous*, and the *rachitic* or *rickety**: to theſe ſome have added the *carcinomatous* or *cancerous**.

---

* Eandem qualitatem (i. e. *fragilitatem*) acquirere poſſunt

It would doubtleſs be greatly foreign to the plan of this treatiſe, to inſtitute a nice inveſtigation reſpecting the exiſtence and different natures of theſe

---

poſſunt oſſa a conſtitutione praeternaturali; ubi ſcilicet humores, vel majorem quantitatem partium terrearum poſſident, vel gluten non ſatis pingue ac viſcidum eſt: qualis praeternaturalis conſtitutio obſervatur; 1. in *lue venerea* affectis. 2. in infantibus *rachiticis*. 3. in iis qui humoribus *ſtrumoſis* ſunt obnoxii.—4. in *ſcorbuticis*. 5. quorum ſanguis accumulatis impuritatibus viſcidis ſcatet, *v. g.* rheumatiſmo vel *arthritide* correptis.——Commer. literar. Noremberg. Vol. 9. p. 354.

Quando neque *ſcorbutica*, neque *ſtrumoſa*, neque *rachitica* cauſa patet, tunc caries *venerea* cenſenda, fragilitas oſſium diagnoſim certam praebet.——cl. Home Princip. medic. de lue venerea.

* Voila donc la fragilité des os, qui eſt l'effet de leur ſéchereſſe, cauſée par l'alteration des ſucs moelleux——Obſervations ſur les effets du virus cancéreux, par M. Louis of the French academy of ſurgery.

theſe vices or morbid ſtates of the ſyſtem; or minutely to mark their limits and characteriſtic diſtinctions: let it ſuffice in general to ſay— that it is highly probable certain *acrimonies* either attend or are generated by all or moſt of theſe diſeaſes; capable to alter, deprave, and ſometimes intirely to deſtroy the nature and *craſis* of the fluids in general, and of their glutinous and oily parts in particular; thus inducing the morbid fragility of the bones in queſtion.

In ſome caſes, the texture of the bones has been ſo much perverted,— as from the ſmalleſt violence, and even muſcular effort, to ſuffer fracture*.

---

* Oſſa nonnunquam fragilia ad minimum ictum, nonnunquam mollia inſtar cerae deveniunt.——Home, Princip. medicin. loco citat.

Mr Gooch's caſes and remarks, Vol. I. p. 398.

Fractures from external violence are only meant to be comprehended under our definition ; and indeed, with propriety, ſuch only fall within the Surgeon's province. Fractures ariſing from internal cauſes, are to be regarded merely as *ſymptoms* depending on ſome ſuch primary and general diſeaſes of the ſyſtem as are recited above ; which, previous to the cure of the fractures, muſt be either corrected or eradicated by medicine.

Old age, and whatever has the ſame effects on the body, as *long continued and hard labour*,—are obſerved to increaſe the fragility of the bones*.

AN intenſely cold or *froſty ſtate* of the atmoſphere has been thought, in like manner, to render the bones more than ordinarily fragile*. The frequency of fractures, during froſty weather, ſeems to have given riſe to this opinion;—the greater ſlipperineſs and hardneſs of the earth in this than in ſoft weather, the one occaſioning more falls, and the other more fractures, ſufficiently account for this fact, independent of the notion of increaſed fragility.

---

* Prof. Monro's Oſteology, p. 18.

Fragilitas oſſium in ſtatu ſano ſenio fere propria eſt— Commer. literar. Norimberg. Vol. ix. p. 354.

Of the Nature and Formation of Callus.

THE Author of nature has wiſely and wonderfully implanted powers in the animal ſyſtem, capable of repairing loſs of ſubſtance and other injuries which it may ſuffer, to a certain extent, and under certain circumſtances. Of theſe, ſurpriſing exertions are every day to be obſerved in many parts of it; but no inſtances of this kind are more remarkable than the *exfoliation*, and conſequent *regeneration* of large portions of the bones,—and the firm *re-union* of their ſeveral pieces after fractures.

---

* Tanto levioribus cauſis fractura naſcitur, quo oſſa ex ſenio, *acri gelu*, lue venerea, ſcorbuto, arthritide, rachitide, carie, aliove vitio, fragiliora ſunt.——Gaub. Pathol. Sect. 217.

The ſubſtance, by whoſe intervention the concretion of the fragments of the bones is effected, is named *Callus**.

Authors are much divided about the ſource whence the callus flows:

---

* Les vuides qui pourroient ſe trouver entre les pieces fracturées, ſont remplis d'une ſubſtance organiſée, (*callus*) analogue a l'os, et qui le ſoude enfin a lendroit de la fracture.—*M. Petit ſur les maladies des os. Tom.* 2. *p.* 51.

while *M. de Hamel* contends, that it is furniſhed ſolely from the perioſteum; the learned and indefatigable *Haller*, with greater probability, aſſerts, that it is only effuſed from the ſubſtance of the fractured bones*.

When

---

* Succum oſſium craſſioribus particulis gravem inter fibras primaevas diſponi, calli ſubnaſcentis phaenomina declarant, qui ex *intimo oſſe*, non ex perioſteo, guttulis quibuſdam exſudat, et ſenſim induratur.—*Haller, prim. lin. phyſiol.* DCCCCXVIII.

Our late celebrated Prof. Monro ſeems to have been much of this opinion. His words are:—"That the part of a bone formerly fractured and re-united by a callus muſt be ſtronger than it was before the fracture happened, which is a wiſe proviſion, ſince bones are never ſet in ſuch a good direction as they were naturally of; and then, when even a callus is formed, there is ſuch an obſtruction of the veſſels, that if the bone was again broke in the ſame place, the oſſific matter would not be ſo eaſily conveyed to re-unite it."——*Prof. Mon. Oſteol. p.* 26.

His traditis ad calli examen progredi licet, atque concludere duplice callo inter ſe unire fracta. Externo qui ex gelatina intra perioſteum, ex vaſis, ſeu fibris oſſeis exſtillanti, gradatim in os condenſatum fit, quem-ad-modum omnis

WHEN newly effuſed, this matter is found to have an appearance ſimilar to the *mucus* or *gluten*, the rudiments of the future bones in the very young fœtus before mentioned: by degrees, from the acceſſion of the oſſific matter, it ſoon becomes equal to the bones themſelves in hardneſs and ſolidity.

THE young callus, however, never aſſumes the oſſeous nature,—till it has been pervaded by the veſſels carrying red blood, ſhooting from the neighbouring parts*. By this means it acquires an organization analogous, though inferior in degree, to that which the bones naturally enjoy.

The

---

omnis oſſificatio; et interno, ſeu internarum lamellarum oſſiarum ſeparatione atque elongatione.—*Edinburgh eſſays, phyſical and literary, Vol.* III. *Article* xxviii. *Dom. Pet. Camper. Obſervationes circa callum oſſium fractorum.*

* Callus oſſeus nunquam convaleſcit, niſi cum rubra vaſa nuper ſubnata penetraverunt.——*Haller, prim. lin. phyſiol.* DCCCCXVI.

The morbid ſtates of the ſyſtem already enumerated, as pre-diſponent to fracture, alſo greatly influence the formation of *callus*. Sometimes they not only retard, but altogether prevent it. The ſcorbutic *diatheſis* is particularly fatal to the growth of *callus*; it has been obſerved to deſtroy it in its moſt confirmed ſtate; fractures, after having been re-united for many years, have appeared in conſequence of this affection as if recent*.

It is alledged, that the ſtate of *pregnancy* is unfavourable to the production and perfecting of callus; and, for this reaſon, fractures happening during that period are ſaid to admit only of very ſlow cure.

The time requiſite to confirm or perfect the callus, after fractures, muſt be different in the different bones; and in patients of different ages and conſtitutions: At a medium, it has been ſuppoſed, that the fractured *radius* may unite within a month, ; the *ulna* and *humurus* within two months; the *os femoris* ſeldom under ſeven, or perhaps ten weeks*.

---

* See the Hiſtory of Lord Anſon's voyages.

As the formation of callus is thus altogether Nature's work, and cannot be influenced by artificial means; the abſurdity of all topical and quackiſh applications, as well as internal remedies, with a view to haſten it, or, when formed, to diſſolve or ſoften it,—is too ſelf-evident to require illuſtration†.

Of

---

* Dr James's medical dictionary under the word Fracture.

† Quid porro manifeſtius eſt, quam fracta poſtquam conferbuerunt valentiora reddi? quid, contra, abſurdius quam credere, callum jam formatum, remediis externis mercurialibus, balneis vaporoſis, vel aqua calida fotum, diſſolvi

Of the Symptoms of Fracture, with their Rationalia.

If the power or violence inflicting fractures, at the ſame time makes a wound or opening in the integuments and muſcular parts,—or, if the fragments are puſhed through theſe, ſo as to be ſeen or felt; they are ſaid to be *compound* or *complicated*;—in oppoſition to thoſe un-attended with this circumſtance, which are therefore named *ſimple.*

---

diſſolvi ac molleſcere poſſe? quid tandem ab ipſa natura magis alienum, quam remediis externis calli generationem adjuvare velle?

Nemo adeo inſanus eſt, confido, qui his perſpectis, remedia ſpecifica callum generantia intus propinare; aut ex ſignis ab auctoribus prolatis judicare auſit, utrum jam factus ſit callus, nec ne?—*Edinburgh eſſays phyſical and literary, Vol.* III. *Art.* xxviii. *Dom. Pet. Camper, Obſervationes circa callum oſſium fractorum.*

See Dr Alſton's materia medica, under the article *ſarcacolla.*

Respecting the exiſtence or non-exiſtence of compound fractures, even the leaſt verſant in this ſubject can have no doubts; they are ſelf-evident. In ſimple fractures this is however far from being always the caſe: inſtances are not wanting, where *contuſions* have been miſtaken for, and treated as fractures; and where, on the other hand, fractures have been regarded as diſlocations, contuſions, ſprains,—and the error detected too late to admit of remedy. Some circumſtances, indeed, ſuch as, the natural thickneſs of the ſurrounding parts, corpulency, the acceſſion of much ſwelling and tenſion before examination,—often occaſion abundant perplexity to the more experienced; before they can with certainty determine, what the ſtate of the parts really is.

If a cauſe, ſuppoſed equal to inflict fracture, has affected any part of a limb; a preſumption immediately ariſes, that its bone or bones may be fractured. This is determined to be or not to be the caſe, from its being or not being followed with ſome of the principal ſymptoms attending this affection enumerated below; all, or the greateſt part of which concurring, are ſufficient to aſcertain the preſence of fracture: Some of them ſingly are altogether deciſive.

1. VERY acute and pungent pain about the ſuſpected place; eſpecially when the parts are moved, or preſſed with the hand.

2. A GRATING of the fragments on one another is often to be perceived, and even heard; when the fragments are much diſplaced, the inequality thence reſulting is often to be felt with the fingers.

3. CONSIDERABLE ſwelling, tenſion and inflammation, very ſoon occupy the ſurrounding parts.

4. INABILITY to perform any motion with that portion of the limb, which is below the ſuppoſed ſeat of the fracture; this portion is ſometimes affected with numbneſs, or partial palſy.

5. WHEN the affected part or limb is carefully compared with the correſponding part of the ſound limb, or with the ſound limb itſelf,—a preternatural alteration of form, ſuch as curvature or ſhortening, is often obſervable.

THE *rationalia* of all or greateſt part of theſe ſymptoms, diagnoſtic of fracture, will eaſily be collected from the following obſervations:

ALTHOUGH the bones themſelves, for obvious reaſons, are inſenſible; the violence done to the medullary membrane, to the perioſteum, but more eſpecially to the highly ſenſible moving or muſcular parts, muſt create acute and pungent pain—particularly, when farther diſturbed by motion or preſſure.

THE pointed fragments which, from contact only, muſt be extremely irritating, ſometimes penetrate very conſiderably into the ſurrounding muſcular ſubſtance,—and thus become a *ſtimulus* ſtrong, direct, and conſtant; cauſing an increaſed determination of blood and nervous influence to the ſurrounding parts, productive of ſudden ſwelling, tenſion, and inflammation,—often terminating in large ſuppurations, &c.

For the ſame reaſons, the *vis inſita muſculorum*, or natural contractility of the moving fibres, is much excited; and being now, in a great meaſure, unreſiſted by the bones, their fragments are often obliged to over-lop or paſs one another,—thus occaſioning curvature, ſhortening or other diſtortion of the part or member. If adjacent nerves happen to be compreſſed by the fragments, numbneſs of the parts ſupplied by them, or partial palſy, is a neceſſary conſequence.

The oſcillatory motions of the *vaſa minima* near the fracture, from the ſame cauſes, are alſo very much increaſed; generating, what may very properly be called a *topical fever*: in many caſes this becomes ſo conſiderable, as to be able to propagate itſelf generally over the ſyſtem; or to induce increaſed action of the heart and larger er arteries, ſo well known by the appellation of *ſympathic* or *ſymptomatic* fever.

Of the Prognoſis *of Fractures.*

FRACTURES, with reſpect to the ſurrounding parts, as has been already ſaid, are divided into *ſimple* and *compound*; with reſpect to the bones, they may alſo be divided very properly into *tranſverſe*, (Plate I. Fig. I. C.) and *oblique*, (Plate I. Fig. I. B.)

FRACTURES are more or leſs dangerous and moleſting, according to the degree of violence which the ſurrounding parts have ſuffered; for this reaſon, ſuch as are joined with wounds or contuſions of theſe parts, as the compound, or thoſe nearly ſo,—are more dangerous, tedious and troubleſome in their conſequences than the merely ſimple.

In the wounds attending compound fractures, the extremities of the fragments would ſeem, for ſome time at leaſt, to act as extraneous bodies. Untill they are covered with granulations, the diſcharge induced and kept up by their conſtant irritation, eſpecially if the parts are moved,—is often ſo immoderate and exceſſive, as very ſoon to weaken the patients.

The general *debility* of the ſyſtem, a neceſſary conſequence of the great diſcharge which ſo often attends wounds of this kind, together with *abſorption* from them,—almoſt always induce *hectic fever*, and its very troubleſome concomitants, *diarrhœa*, &c. The motion unavoidably attending *diarrhœa*, unfortunately augments both the irritation from the fragments, and the diſcharge from the wounds; and is, at the ſame time, moſt unfriendly to the retention and concreting of the fragments,—and makes a great addition to the difficulty otherwiſe attending the retentive part of the healing proceſs. Indeed ſuch caſes but too often terminate fatally.

TRANSVERSE fractures of all others, for very evident reaſons, are ofteneſt ſpeedily and happily cured. Oblique fractures, on the other hand, much ſeldomer complete the patient's and ſurgeon's wiſhes; in ſpite of the circumſpection of both, deformity is not unfrequently the conſequence: The want of ſucceſs would appear to be in proportion to the degree of obliquity; When this is conſiderable, the fragments are, with greater difficulty, preſerved in proper oppoſition, and their extremities are more acute; and, on this account, when diſplaced, they prove more ſtimulant and deſtructive to the fleſhy parts.

THE conſequences of inflammation excited in or near the articulations, on account of the peculiar nature of their conſtituent parts, is always to be dreaded. Fractures, therefore, near the extremities of the bones, are likely to be more dangerous than elſewhere. It is needleſs to add, that if the ſame bone is fractured in more places than one, the danger will be more than proportionally increaſed.

THE above prognoſtics only regard the ſtate of the fractures; but the age and conſtitution of the patients are particularly to be taken into the account. Patients young, and otherwiſe healthy, with greater reaſon and confidence may expect a ſucceſsful cure, of whatever kind the fractures are, than ſuch as are old and diſeaſed. —Fracture, concurring with great age and depraved habit, conſtitute a caſe truly deplorable.

Of the Method of Cure, or Treatment of Fractures.

After being fully convinced, from the concomitant ſymptoms, that a bone is fractured; the Surgeon's buſineſs is to reduce its fragments to their natural ſituation,—and there to retain them, by proper means, till Nature, by the interpoſition of callus, completes the cure.

THIS part of our ſubject naturally divides itſelf into three branches; *Extenſion, Coaptation* and *Retention.*

EXTENSION.

THE contractility or *vis inſita* of the muſcular fibres, during life, is conſtantly exerted; or the muſcles have a conſtant tendency to ſhorten themſelves*, as far as their ſtructure permits: this is only prevented, beyond a certain degree, by the reſiſtance which the bones oppoſe to it.—When therefore the bones are fractured obliquely, or indeed tranſverſely, provided the fracturing cauſe has ſufficiently diſengaged the fragments from one another,—the reſiſtance will be, in a great meaſure, removed; at the ſame

---

[*] See *Inſtitutions* of *Medicine* for *the uſe of the Students* in the *Univerſity of Edinburgh*, p. 68.

time that the muſcular power, from the ſtrong and rude *ſtimulus* of the fragments, is much excited: by this means, the lower fragments are very often forced to over-lop the upper ones. To reduce theſe, extenſion becomes abſolutely neceſſary; and ought to be proportioned to the reſiſtance, which is as the connecting muſcles.

In ſome favourable tranſverſe fractures, the bones are ſimply fractured, and no diſplacement enſues. This circumſtance plainly ſuperſedes the neceſſity of extenſion.

As the buſineſs of extenſion is to reduce the lower fragments, which, for reaſons adduced, can only be diſplaced,—it is eaſy to perceive, that there can be no place for what is called *counter-extenſion*: if any idea is conveyed by this term, it ſeems only to be the retracting of the upper fragments.

In performing extenſion, the upper fragments muſt be fixed, or held ſteadily in one poſture. The traction, or extending power, whether the hands or mechanical aſſiſtance, is to be applied to the lower fragments only; for no good reaſon can be aſſigned, why, by applying it to a more diſtant part of the limb, the interveening articulations ſhould be racked and ſtrained, and perhaps luxation added to fracture.

For another, and perhaps more important reaſon, the application of the extending power to a diſtant part of the limb, is highly improper and unſcientific, *viz.* the muſcles, by this procedure, are all put on the ſtretch, and their tenſion infallibly increaſed;

and conſequently the reſiſtance to the traction conſiderably augmented, which by every poſſible means ſhould carefully be diminiſhed.

A CONSIDERABLE relaxation of the muſcles of the leg and arm is obtained, by keeping the knee and elbow joints in a ſtate of flexion while extenſion is performing: this circumſtance deſerves to be particularly attended to. If a joint intervenes betwixt the fracture and the part to which the extending power is applied, a few ſuppoſable caſes excepted,—this relaxation is not to be effected.

ALTHOUGH this practice of relaxing the muſcles to facilitate the extenſion, as well as retention of fractured bones, ſtands ſupported by anatomical arguments and common ſenſe,—it has been much over-looked by the generality of authors. Some, indeed, have mentioned it*; but the many advantages reſulting from it have never been fully taught by any author, ſo far as we know, before Mr Pot†; to whoſe judicious obſervations, on this and other ſubjects, ſurgery is much indebted.

To accompliſh extenſion, our tractive efforts ſhould at firſt be gentle, cautious and ſteady; and, as may be neceſſary, gradually increaſed. The ſtrength of the hands will almoſt always be found ſufficient for this purpoſe; where it is ſo, it is conſtantly to be preferred to every contrivance whatever. In fractures of the thigh-bone, whoſe ſurrounding muſcles are by far thicker and ſtronger than thoſe of any other part of the extremities,—I have always, with one or two aſſiſtants, been able to effect due extenſion; though, at the ſame time, I am far from doubting, that, in ſome muſcular robuſt patients, the aſſiſtance of the mechanical powers may be found neceſſary; eſpecially when the neck of the thigh-bone is the ſeat of the fracture.

---

* Il faut que les muſcles ſoient autant qu'il eſt poſſible dans un etat d'inaction, et qu 'ils ſoient tous egalement relachés.—*M. Petit, ſur les maladies des os, Tom.* 2. *p.* 31.

See the *Encyclopedie*, under the word *Fracture.*

† *See his general remarks on fractures*, paſſim.

It is very material, carefully to attend to the proper time of operating the extenſion; it ſhould always be performed as ſoon after the accident as poſſible, previous to the acceſſion of the tenſion and inflammation. If, however, theſe are preſent in any conſiderable degree, before aſſiſtance has been procured; it will be prudent not to attempt extenſion, till theſe ſymptoms are either mitigated or altogether removed: otherwiſe our attempts are likely not only to prove vain, but extremely hurtful; from ſuch procedure an increaſe of the ſymptoms is but a natural conſequence.

The tenſion and inflammation are moſt likely to be mitigated or removed by a ſtrict obſervance of the *antiphlogiſtic regimen* in all its parts; particularly blood-letting. In ſanguine, robuſt, young habits,—copious blood-lettings, both general and topical, will be very expedient; no remedy whatever ſo effectually reduces the tone of the arterial ſyſtem, or ſo powerfully deſtroys the *inflammatory diatheſis*. As very much contributing to the ſame end, the application of large, emollient, or relaxant cataplaſms to the fractured part, is to be perſiſted in. Their operation will be increaſed by applying them gently warmed, and frequently renewing them. This is perhaps preferable to the more common mode of fomentation; as its relaxing effects are more permanent. *Saccharum ſaturni* in dilute ſolution is an uſeful addition to the cataplaſms*.

For determining the quantity of extenſion, the rule is,—to proceed till the next ſtep in the curative proceſs can be properly accompliſhed, *viz.*

COAPTATION.

COAPTATION, or ſetting of the reduced fragments, ought to be executed with all poſſible accuracy and attention; on it the future ſhape, and perhaps uſefulneſs of the limb may, in a great degree, depend.

---

* *See Goulard's* treatiſe *de l'extrait de ſacch. ſaturn.*

Accurate anatomical acquaintance with the ſtructure of the parts concerned, will here be the Surgeon's beſt aſſiſtant; ſome information may be gained, by carefully comparing the affected with the correſponding ſound limb.

The other ſteps in the treatment of fractures are, as it were, only ſubſervient to coaptation.—By extenſion the limb is reſtored to its due length; by coaptation it regains its natural form; which we endeavour to maintain by the laſt ſtep, or

RETENTION.

After coaptation, properly to effect the retention of the fragments *in ſitu*,—is by far the moſt arduous part of the Surgeon's taſk, in the management of fractures; unſucceſsfulneſs in this point fruſtrates all his former labour, and often ſubjects him to the moſt mortifying reflections from the concerned.—Although the diſtortion and deformity, which muſt be the unavoidable conſequence of failure here, may in juſtice be ſolely imputable to the imprudent conduct of the patient; or may be the effect of accidents unforeſeen, or not to be prevented;—the inconſiderate part of mankind, which is by no means the leaſt numerous, will without heſitation ſtate the whole blame to the Surgeon's account.

Some of the chief ſources whence the difficulty of retention flows, are the following:

1. *The thickneſs of the ſurrounding muſcles.*—This circumſtance, beſides increaſing the muſcular ſtrength or con-

tractile power, by which the fragments are diſplaced, adds to the difficulty in another way; by it our retentive applications are kept at too great diſtance from the fractured bones, whereby their influence is either diminiſhed or totally deſtroyed: ſo that when they are made with as great ſtricture as is compatible with the ſafety of theſe ſurrounding parts themſelves, little or no reſiſtance is oppoſed to the derangement of the fragments. This is peculiarly the caſe in the thigh; for this reaſon, by *Hildanus* it is compared to a bone ſurrounded with a thick pillow*.

2. *The obliquity of the fracture.*—Nothing can be more evident than that the greater this obliquity is, the contractile *niſus* of the muſcles, and derangment of the fragments will be leſs

---

* *Hildani opera, Cent.* V. *Obſervat.* 86.

reſiſted and more eaſily effected; or the difficulty of retention augmented.

3. *The unfavourable external form of the part affected.*—The more this deviates from the cylindrical and approaches to the conical ſhape, our applications have a more unfavourable hold of the included parts. The form of the thigh is a ſtrong inſtance of this obſervation, particularly if the patient is muſcular and plump.

4. *The reſtleſſneſs of patients.*—It is needleſs to obſerve, after what has been ſaid, how abſolutely neceſſary to obtain a complete cure, preſerving the limb ſteadily in one ſituation muſt be; or how eaſily, eſpecially in oblique fractures, by the ſmalleſt motion, the fragments may be deranged. If, from the thoughtleſsneſs of youth, our patients are fretful and unmanageable,

they are ſurely excuſeable; but no apology is ſufficient for the peeviſh diſcontent, and provoking inattention of ſuch as are more advanced in life.

5. *Accidents*; ſuch as *convulſive ſtartings, cough, aud reaching to vomit.*—All theſe are very readily induced, in the more delicate or mobile ſyſtems, by the *ſtimulus* of the fragments; as they occaſion much concuſſion of the whole body, they muſt of neceſſity very often derange the fragments after coaptation.—To this head belongs *diarrhœa*; the cauſe and moleſting nature of which are mentioned above.

From theſe obſervations, the difficulty of retaining fractured bones *in ſitu* muſt be very evident. Indeed, to effect retention properly has ever been regarded as a very important buſineſs; and has accordingly, at all times, afforded abundant exerciſe to the invention of the ingenious practical Surgeon,—as will hereafter appear.

Deligation of various kinds, and *Poſture,*—comprehend the retentive means employed in fractures.

Deligation.—This includes *bandages* of every kind; as well thoſe made of ſoft materials, ſuch as cloths of all ſorts, *&c.* as thoſe conſtructed of harder and more reſiſtant ſubſtances, ſuch as leather, wood, metal, *&c.* called *machines.*

BEFORE giving particular directions for performing deligation, it may not be improper, once for all, to intimate,—that the intention of bandages is, in tranſverſe fractures, to protect the fragments from derangement by *external* cauſes, which alone can affect them; in oblique fractures, to reſiſt the deranging effects of both *internal* and *external* cauſes, as they are affected by either. The internal cauſe here chiefly alluded to, is the contractile *niſus* of the muſcles; to which the bones, in a ſound ſtate, oppoſe a reſiſtance. If, therefore, by bandages in oblique fractures, a temporary ſubſtitution to the now-deficient reſiſtance of the bones is not afforded,—they muſt either do miſchief, or nothing.

FROM this view of the intention of bandages in the management of fractures, we muſt certainly conclude, that it can never be completed by ſuch alone as conſiſt altogether of ſoft and pliant materials. For this reaſon it is, that *ſplints* of metal, wood, leather, paſteboard, or the like,—have always made an eſſential part of the moſt ſimple *apparatus* for the retention of fractured bones.

The *roller-bandages*, on account of the motion and diſturbance which the fragments muſt ſuffer from applying and removing them, are moſt improper and inconvenient in the cure of fractures; and are juſtly ſuperſeded by bandages with eighteen or twelve tails,—or others conſtructed on the ſame principle, ſuch as thoſe deſcribed by Scultetus* and Mr William Sharp†, (Plate I. Fig. 5.): and as, by their means, the ſtate of the fracture can be conveniently and ſafely inſpected; they are peculiarly adapted to the cure of compound fractures,—where the roller-bandages can have no place.

---

* *Sculteti armament. chirugicum*, Tabul. xxvii. Fig. 1.

† *Philoſophical Tranſactions*, Vol. 57. Part 2. 1767.

Some practitioners prefer theſe bandages when made of flannel, to ſuch as are made of linen cloth,—from an opinion that they can be applied with greater firmneſs and neatneſs; at the ſame time, in caſe of ſudden ſwelling ſupervening, they yield a little,—and conſequently are not ſo apt, as the linen ones, to impede the circulation.

The ſplints moſt commonly employed are made of paſteboard. When gently moiſtened before application, they very perfectly aſſume the ſhape of the part included; and thus very much favour and facilitate the retention of the fragments: which, indeed, is chiefly effected by the action of the ſplints; the bandages may be conſidered as only ſubſervient.

Leather-splints are extolled by ſome, as much ſuperior to the paſteboard ones; particularly in compound fractures, where the rigidity of the paſteboard is altogether deſtroyed by the matter diſcharged from the wounds,—and by the moiſt applications that may be neceſſary*. This is undoubtedly true; but, in ſuch caſes, either of them is much inadequate to the taſk.

WHETHER the paſteboard or leather ſplints are employed, they ought to be long enough to reach the full length of the fractured bone, *i. e.* from the joint above to the joint immediately below the place of the fracture. At the ſame time that theſe long ſplints very much contribute to ſecure the fragments againſt alteration,—they preſs leſs than the ſhort ſplints commonly uſed, on the place of the fracture where the inflammation and pain are greateſt.

---

* *See Mr Wathen's* Conductor *and* containing ſplints. page 13.

As to the requiſite number of ſplints, two of proper breadth are ſufficient. They are to be lined with thick compreſſes of folded linen; ſtitching the compreſſes to the ſplints greatly facilitates their application. On the back part of one of the ſplints, ought to be fixed, at proper diſtances, ſeveral ſtraps of ſtrong tape, of ſuch length as to be able to ſurround the limb, and tie over the oppoſite ſplint.

SPLINTS intended for the leg, muſt have a hole in each of their lower extremities to receive the ancles; which contribute a good deal to render them more effectual. A ſplint for the leg, formed in this manner, is repreſented in Plate I. Fig. 4.

If ſplints thus conſtructed are properly applied, ſcarcely does any further bandaging ſeem neceſſary; for it is doubtful, if by it the ſecurity againſt alteration in the ſtate of the fragments can be increaſed: if, however, any more *apparatus* ſhall ſtill be thought proper,—the bandages mentioned above, are undoubtedly preferable to thoſe of the roller-kind.

Poſture.—It is a very material point, after having proceeded thus far,—to contrive a method of repoſing the diſeaſed limb, that may equally quadrate with the curative intention and the patient's eaſe.

When treating of extenſion, it was obſerved,—that a relaxed ſtate of the muſcles very much facilitated the retention of the fragments; that poſture of the limb, therefore, in which the greateſt number of muſcles are relaxed, is here to be carefully conſulted: eſpecially if the patient is muſcular, and the fracture oblique.

If the fracture is aſcertained to be of the tranſverſe kind, or nearly ſo; after the coaptation is properly executed, I know no reaſon, of any force, why the relaxed ſtate of the muſcles ſhould be much regarded. On the contrary, perhaps, their being conſtantly on the ſtretch,—by firmly oppoſing the ends of the fragments to one another, may not a little contribute to retention.

When the arm-bones are fractured, the relaxed ſtate of the muſcles is naturally and univerſally adopted: To ſay any thing farther on this part of our ſubject, is therefore altogether unneceſſary. When the bones of the lower extremities are fractured, it is much more difficult to maintain the muſcles relaxed. Mr Pot reſts the ſucceſsful cure of fractures, thoſe of the *os femoris* not excepted, almoſt totally on the obſervance of this circumſtance: he directs the patient to lie on the ſide which correſponds with the fractured limb; by which means the limb being laid on its ſide above a pillow, the knee-joint can be kept in a ſtate of flexion.

It may be objected to this poſture of the leg and body, that properly to effect it in common practice is impracticable. The matraſs-bed, on which the patient lies, ſhould be of an equal hardneſs in every part,—that his body and leg may remain, during the whole cure, in the ſame plane: for if the body ſinks more than the leg, (which it always does when laid on beds conſtructed with the ordinary materials, ſuch as, feathers or chaff,) they ſoon come to be in very different planes; and thus there is danger of diſtorting what we meant to rectify. In hoſpitals, indeed, ſuch equally-hard matraſs-beds may be purpoſely conſtructed; but in common practice the caſe is very different.

ADMITTING this difficulty, reſpecting the inequality of the bed, to be ſurmounted; it may ſtill be ſaid, that lying on the ſide becomes much ſooner irkſome than the ſupine poſture: becauſe, in the former ſituation, the weight of the body is ſuſtained by a leſs and more unequal ſurface than in the latter; the arm, alſo, of the ſide on which the patient lies,—is ſo much hampered and confined, as to prevent him from taking diet or medicine, though placed within his reach. That to patients labouring under fractures, a ſituation as little irkſome and inconvenient as poſſible ſhould be choſen,—is highly expedient; when it is conſidered, how tedious the cures often are: and that the ſmalleſt alteration of poſture, for the ſake of eaſe, will often prove ſufficient to defeat all that has previouſly been done.

IT may be here alledged,—that the patient may reſt chiefly on his back, and keep his leg, notwithſtanding, on its ſide, in a ſtate of flexion.—This obviates the objection, as to the leg ſtrictly ſo called; for undoubtedly the muſcles may attain to all the relaxation which poſture alone can yield, while the patient remains in a ſupine ſituation. This is, however, by no means the caſe with the thigh; for unleſs the patient really inclines very conſiderably to the ſide, the ſtrong *muſculi adductores femoris* will in ſome degree be kept on the ſtretch: when the fracture is in the neck of the thigh-bone, or near its *trochanter major*,—how much this circumſtance muſt counteract the curative intentions, it is eaſy to conceive. Wounds attending fractures ſituated on the external parts of the leg, altogether preclude the ſide-poſture.

SURGEONS hitherto have been more employed in adapting their patients, by poſture, to the ordinary form of beds,—than of altering and accommodating this form itſelf.

THE relaxed ſtate of the muſcles of the thigh and leg can be obtained, while the patient lies freely on his back, by the following method; againſt which fewer objections ſeem to lie than againſt the other. I have known

patients

patients remain nine or ten weeks very ſteadily on their backs; but never any, for half that time, with ſuch conſtancy on their ſides.

In fractures of the thigh-bone, the patient's body is to be elevated a foot or eighteen inches above the general ſurface of the bed. The ſimpleſt method of effecting this, is to double up the proper matraſs of the bed; ſo as that the legs, from the knees downwards, may project over the doubled part of it,—to allow of the flexion of the knee-joints. (Plate III. Fig. 2.) By placing the patient in this way, in the day time, the body, by means of a bed-chair, pillows, &c. may, without occaſioning the ſmalleſt diſturbance to the fragments, (unleſs the fracture is in the neck, or very near the upper part of the bone), be raiſed to the ſitting poſture.—How ſoothing this grateful alternation muſt be, and how much it will diminiſh the irkſomeneſs of long confinement,—is eaſier to be conceived than expreſſed.

When the fracture is ſituated below the knee, the leg, from the knee downward, is to be raiſed and kept in a plane fourteen or fifteen inches higher than the ſurface of the bed,—that the knee-joint may admit of ſuch a degree of flexion as is ſufficient for relaxing the muſcles. The height of the one plane above the other, both for the thigh and leg, muſt be varied according to the ſize of the patient: this elevation of the leg can be eaſily effected, by placing pillows above one another, or by any other contrivance which time and place may ſuggeſt. (Plate III. Fig. 1.) By this method, alſo, the patient may be regaled with the ſame alternation of poſture propoſed above.

If the dependent ſituation of the leg, when the thigh is placed as recommended above, ſhould be thought or found to induce ſwelling, or to increaſe it; it may be raiſed nearer to the level of the body, without much diſadvantage: for a conſiderable variation of the angle of flexion has but little influence in ſtretching or relaxing the femoral muſcles.

The only circumſtance that can render the poſition of the thigh and leg above mentioned impracticable, is the accident of wounds in their back part: in this caſe, the other method muſt be adopted. By means of a flat baſin and urinal, the *fæces* and urine can be received with abundant convenience,—whether the patient be placed in the one or other of theſe ways.

THE

Of FRACTURES of the THIGH-BONE.

THE difficulty of conducting the cure of fractures of the thigh-bone, is known and confeſſed by all*. The genius and invention of the beſt Surgeons have been much exercifed, to deviſe a method of treatment by which this might be obviated. However, as the number of fractures of this bone is almoſt equalled by that of conſequent deformities, ſuch as, ſhort and decayed legs, *&c.* the proof that their labours have hitherto

---

[*] Neque tamen ignorari oportet, ſi femur fractum ſit, fieri brevius; quia nunquam in antiquum ſtatum revertitur, ſummiſque digitis poſtea cruris ejus inſiſti; ex quo multa debilitas eſt; fœdior tamen ubi fortunae negligentia quoque acceſſit.—*Celſus de medicin.* page 537.

therto been much unſucceſsful, is but too plain.

THICKNESS and ſtrength of the ſurrounding muſcles, together with conical ſhape ſo peculiar to the thigh,—principally create the difficulty of retention, which always occurs in fractures of this bone; when with theſe are conjoined obliquity of fracture, and the accidents ſo often defeating our retentive applications before mentioned,—the taſk becomes more and more arduous.

FRACTURES in the neck of this bone, which, on account of its ſpongy texture, happen much oftener than was formerly imagined,—are, from its natural ſituation, always oblique, with reſpect to the common *axis* of the bone, and the direction of the femoral muſcles, (Plate I. Fig. I. F.);

this circumſtance renders the retention of fractures here more difficult—than in any other part of this bone.

THE grand *deſideratum* is, by ſome means or other, to create a temporary ſubſtitution to the now deficient oppoſition which was afforded by the bone to the contractility of the femoral muſcles; as well as to prevent derangement of the fragments, from any accidental motion of the leg or body.—Any *apparatus* or mode of dreſſing for a fractured thigh-bone, incapable of compleating theſe intentions, is evidently very much defective.

THIS ſubſtitution to the deficient reſiſtance of the bones, can only be made by aſſuming two fixed points, the one above and the other below the place of the fracture,—which are to be maintained at the ſame diſtance from one another which they held after coaptation, till the reuniting callus is ſufficiently confirmed.

Upon this principle, we reject the ſpica-bandage, junks, and the like; as altogether unequal to retain the fragments in the ſituation in which they were placed by coaptation.—The patient would undoubtedly be leſs tormented, and the deformity would not probably be greater,—were the caſe, after coaptation, intirely committed to nature; and no trial made towards a cure by ſuch inadequate and prepoſterous means, as the common practice employs*.

The method of placing the thigh on its ſide, as directed by Mr Pot, and truſting the retention altogether to this poſture, I am much inclined to regard—as doing little more than leaving it to nature. In oblique fractures eſpecially the contractile *niſus* of the ſtrong and numerous femoral muſcles forbids us to expect retention from poſture alone, however well contrived. Indeed, ſplints ſecured with ſuch bandages as are formerly deſcribed, are not neglected; however, for the reaſons adduced above, the additional ſecurity reſulting from theſe is very inconſiderable. Keeping the muſcles, as much as may be, relaxed by the method already recommended,—no doubt, contributes conſiderably towards retention; by ſomewhat ſhortening the line of their contractility,—and rendering them leſs apt to pull the fragments over one another, than when the leg is fully extended in the ſame plane with the body: yet ſuch long muſcles are ſtill capable of contracting much more; and always do ſo, as ſoon as the fragments loſe their oppoſition, and the reſiſtance to their further contraction conſequently removed*.

---

* See Mr Northcote's *marine practice* lately publiſhed. Treating of fractures of this bone, he ſays, "The cure is to be attempted by the *ſpica bandage* and the *axis in peritrochio*, (to be got of the Inſtrument-makers").

From the foregoing obſervations, it follows,—that if retention of the fragments of the *os femoris* is at all to be effected, it muſt be by *mechanical means*; calculated to fulfil the purpoſes above enumerated, with as great ſafety to the parts, and eaſe to the patient, as poſſible.

By mechanical means are here underſtood ſuch only as are conſiſtent with the relaxed ſtate of the muſcles, whether to obtain it the patient lie on his ſide or on his back; therefore the above concluſion by no means contradicts what Mr Pot ſays in the following paſſage; where, apprehending that ſuch aſſiſtances were inconſiſtent with keeping the muſcles relaxed, and reſolving to confide in poſture only for a perfect cure, his words are: "If I meant to deſcribe, or if I approved (pardon the phraſe) the common method of placing the broken leg and thigh in a ſtraight manner, this would be the place to mention the many very ingenious contrivances, and pieces of machinery, which practitioners, both antient and modern, have deſcribed for the purpoſe of keeping the whole limb ſtraight and ſteady; that is, of keeping all the muſcles ſurrounding the fractured bone upon the ſtretch, and, at the ſame time, of preventing any inequality in the union of it, and any ſhortening in conſequence of that inequality; but as my intention is to inculcate another, and, as it appears to me, a better diſpoſition of the limb, in which ſuch boxes, cradles, and pieces of machinery are not wanted, or cannot be uſed,—it is needleſs to ſay any thing about them*."

---

* Longe infra tertiam partem longitudinem muſculi diminui adparet. *Haller prim. lin. phyſiolog.* Sect. cccci.

I SHALL take the liberty to make a few remarks on ſome of theſe mechanical contrivances or machines, which have been recommended to accompliſh retention of the fractured *os femoris.*

THE caſe of a young girl, who, by a fall from a houſe-top, had fractured her thigh-bone, is narrated by the celebrated *F. Hildanus*†. The fracture was near the upper part of this bone, the leg was conſiderably ſhortened; and, from the over-loping of the fragments, a large tumor was perceived externally at the place of the fracture. Extenſion, coaptation, and deligation were performed; and, for fourteen days, every thing ſucceeded to his wiſh: in the night-time, however, being peſtered with flies and fleas *(muſcae et pulices)*, ſhe had altered the ſituation of her body, by which the fragments were diſplaced; ſo that, on viſiting her in the morning, he found her leg ſhortened, and the tumor returned. Extenſion, &c. were repeated, and the ſame accident followed: he now deſpaired of ſucceſs, and thought it vain to make any further attempts towards a perfect cure.

---

* See his general remarks on fractures, p. 44

† *Hildani opera*, Cent. V. Obſervat 86.

When in this predicament, he happily contrived a machine, (Plate I. Fig. 3.); the invention of which (with more devotion than falls, I am afraid, to the lot of many of his modern brethren) he piouſly aſcribes to the inſpiring aid of heaven: by it he effected perfect retention and cure.

THIS machine conſiſts of an iron-plate, AA; of ſufficient length to reach from the top of the *pelvis* to below the knee; properly hollowed, to receive the external part of the thigh,—and lined with ſoft materials: it is provided with three belts;—one BB is fixed round the *pelvis*; the other two, CC and DD, fixed round the leg,—the one above, the other below, the knee-joint.

THOUGH this machine, to retain the fractured thigh-bone, is deficient in ſome neceſſary requiſites; and ſeems chiefly to act by preſſure on the place of the fracture, and calculated for the extended poſture of the leg:

yet it is by far more likely to effect the retention of the fragments of this bone, than any of the retentive means commonly employed,—particularly than junks. It is ſurpriſing, it has not been oftener made uſe of. By omitting to tie the belt, which paſſes below the knee,—it permits flexion of the knee-joint, with a view to relax the muſcles, in which-ever of the two poſitions above-mentioned the leg is placed: This is an advantage not attended to by its author.

THE following paſſage from Doctor James's medicinal Dictionary, is not foreign to our ſubject. After remarking the difficulty of retaining the fragments of this bone *in ſitu*, he ſays; " it would be worth while to invent a machine to preſerve a fractured thigh in a due extenſion; ſo that the injured limb may be kept of the ſame length with the other, for fourteen days or more,—or indeed, during the whole time of the cure; for then you might reaſonably expect a certain and more ſucceſsful conglutination. Though Hildanus has deſcribed an inſtrument, proper for the extenſion of oblique fractures; yet it is to be feared, it is ſomething imperfect. In the mean time, ſince we are without a better, and the method by bandage, above deſcribed, is not thought ſufficient; it will not be amiſs to apply that machine of Hildanus, *&c.*"

The next I ſhall mention, is one invented by M. Belloq, a very ingenious Surgeon of the Royal Academy of Surgery in France,—approven of by that learned and reſpectable body; and which M. Belloq found to ſucceed in two caſes of oblique fracture of the *os femoris*, after he had in vain tried the bandaging *apparatus* commonly employed in ſuch caſes*.

M. BELLOQ calls it a *mechanical bandage.* It can only be applied when the leg is in an extended poſture; therefore, according to our principles, it cannot be here recommended. Independent of this objection,—its very complex, though artful conſtruction, will, we are afraid, prevent it from ever being adopted by the general practice.

THE very ingenious Mr Gooch, an eminent ſurgeon in Norwich, has invented and recommended a machine; expreſsly calculated to perform retention of the fragments of the *os femoris,*

(Plate

---

* For a particular deſcription and delineation of M. Belloq's machine,ſee [Memoires de l'Academie royale de Chirurgie, tom. iii. p. 233. Deſcription d'une machine pour les fractures obliques du corps du femur et celles de ſon col.]

(Plate I. Fig. 2). It conſiſts of three jointed circulars, lined with ſoft materials to ſurround the limb. The upper one AA applies to the upper part of the thigh, the other two are connected together; the one BB fixes above the knee, the other CC below it, the better to divide the preſſure: they are therefore to be regarded only as one. This, and the upper one, are connected by two pillars DD, one on each ſide of the thigh; ſo contrived, that by turning the ſcrews FF by the key E, they are elongated at pleaſure, and the two circulars are farther removed from one another: or the intervening portion of the thigh in which the fracture is ſuppoſed to be, is kept extended to its natural length; and a ſubſtitution provided againſt the action of the muſcles, in place of that which the bone in a ſound ſtate afforded. His own account of it is as follows:

“ How to keep a fractured thigh duly extended, particularly in adults, has exerciſed the thoughts of ſome of the ableſt ſurgeons; and it is a point of great conſequence to be well effected.

“ SEVERAL years ago I had a machine made for this purpoſe, according to a ſketch I drew of it before; and ſoon had a fair opportunity of trying its uſefulneſs. It anſwered my deſign the firſt time I uſed it beyond my expectation, in a very bad oblique fracture; attended with a vexatious cough, which occaſioned extreme pain by ſhaking the limb, and deprived the patient of his reſt: it kept the part, ſenſibly to himſelf, in a gentle extenſion, and the limb in a ſteady poſture,—ſo that it was not the leaſt affected by the cough afterwards; which before, according to his own expreſſion, gave him ſuch a ſenſation of pain, as if the ends of the bones were thruſting into the fleſh. This machine being lined with ſoft oiled leather, and well ſtuffed with wool,—ſat very eaſy on the part, without cauſing any excoriation. Pieces of buff-leather will defend the limb againſt the machine, as well as the other lining and ſtuffing,—as has been particularly tried; but very particular caution is neceſſary, to guard the inſide of the thigh.

" THIS machine is very ſimple in its conſtruction, and intended to maintain its power upon the limb in any poſture neceſſary to put it or the body in;—and I hope the repeated trials of other ſurgeons will farther confirm its utility, even in fractures upon the neck of this bone*."

THE

---

* See his Caſes and Remarks, vol. I. p. 307.

An objection to this machine is,—that it cannot ſafely be brought to act with force ſufficient to reſiſt the contraction of the muſcles; becauſe of its upper circular, which being intirely fixed on the ſoft muſcular parts of the thigh, not only the circulation in the limb in general, but that in the great veſſels which run on the inſide of the thigh in particular,—is in danger of being greatly impeded: and ſo ſwelling, inflammation, and perhaps gangrene of the whole leg induced; unleſs provided againſt with the greateſt circumſpection. The author himſelf indeed acknowledges, that "great caution is neceſſary to guard the inſide of the thigh."

Though the upper circular thus embracing the thigh in its upper or middle part, where the circulation is altogether unprotected againſt its action,

tion, creates an objection to this machine; this cannot be ſaid of its lower one,—which is prevented from ſenſibly impeding the circulation, by the ham-ſtrings, or tendons of the flexor muſcles of the leg, between which the crural veſſels paſs ſecurely. The two circulars connected inflexibly together, however, render the flexion of the knee-joint, and conſequently the relaxing of the muſcles, impoſſible.

When the neck of this bone is fractured, the *trochanter major* is drawn upward on the lateral and back part of the *pelvis*, conſiderably above the *acetabulum*, by the contracting muſcles, (Plate I. Fig. 1. d). To this circumſtance the ſhortening of the leg, always conſequent to fractures here, is owing: as Mr Gooch's machine does not lay hold of the *pelvis*, but of the thigh itſelf; it is to be feared that, in this caſe, it would not properly effect retention, —although it could otherwiſe be uſed with the greateſt ſafety.

Explanation of PLATE I.

FIG. I.

REPRESENTS the bones of the *pelvis*, with the thigh-bones fractured in various directions.

A. B. C. TRANSVERSE and oblique fractures of the left thigh-bone; where the fragments are, notwithſtanding, ſuppoſed to remain *in ſitu*.

O. O. THE pricked lines mark how, in the caſe of oblique fracture, as at B, by muſcular action,—the inferior fragment is made to overlop the ſuperior one; thus cauſing a ſhortening of the thigh.

The right thigh-bone is ſuppoſed to be fractured in its neck.

D. The ſituation the *trachanter major* may be ſuppoſed to take, in conſequence of fracture of the neck of this bone.

E. The articular extremity of this bone, ſtill inherent in the *acetabulum*.

F. The oblique ſituation of the neck of this bone, in a ſound ſtate.

Fig. 2.

Represents a machine invented by Mr Gooch, for the retention of the fragments of the thigh-bone.

A A. A jointed circular, which ſurrounds the thigh at its upper part.

BB. CC. Two of the ſame kind, connected by the rigid bars GG; the one fixes above, and the other below the knee-joint.

DD. Two wooden pillars, which paſs on each ſide of the thigh, between the upper and lower circulars, furniſhed with ſcrews at their inferior extremities; which turned equally by the key E, muſt increaſe the diſtance between the circulars, and thus keep extended the intermediate portion of the included thigh.

FIG. 3.

REPRESENTS a machine; invented for the ſame purpoſe, by the celebrated Hildanus.

AA. A hollowed iron-plate, covered on the inſide with ſoft materials;

proportioned in ſize to the thigh for which it is intended.

BB. A BROAD belt which ſurrounds the *pelvis.*

CC. DD. TWO others of the ſame kind, at the inferior part of this machine; the one fixes above, and the other below the knee-joint.

FIG. 4.

REPRESENTS a paſte-board ſplint armed, for the retention of the fractured leg-bones.

AA. THE ſplint, with a compreſs of folded linen ſtitched to it; perforated at its inferior extremity, for the reception of one of the ankles.

aa. TAPE ſtrapes fixed to its back part

PLATE 1

Fig. 1.

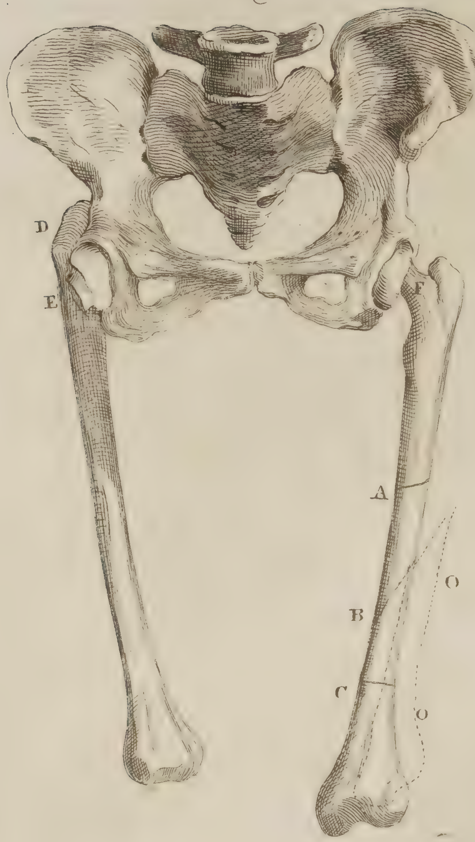


Fig 2

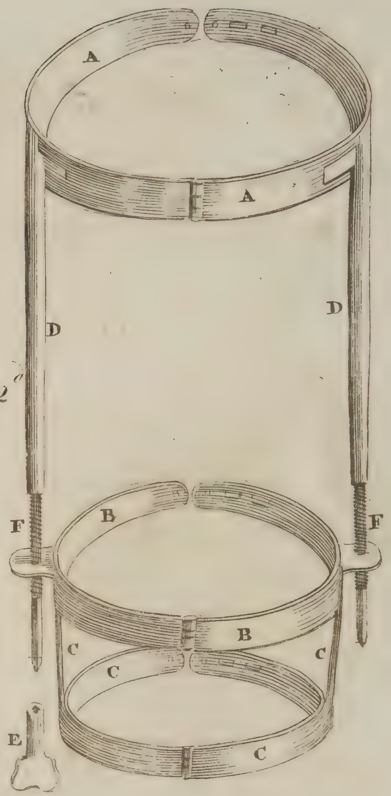


Fig. 4

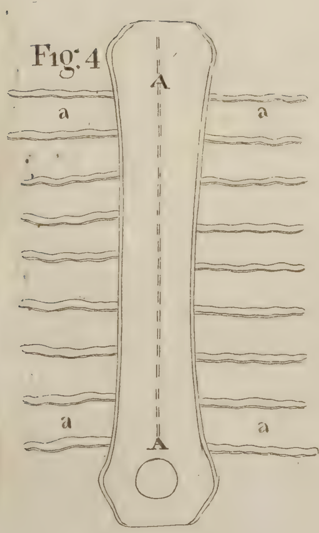


Fig 5

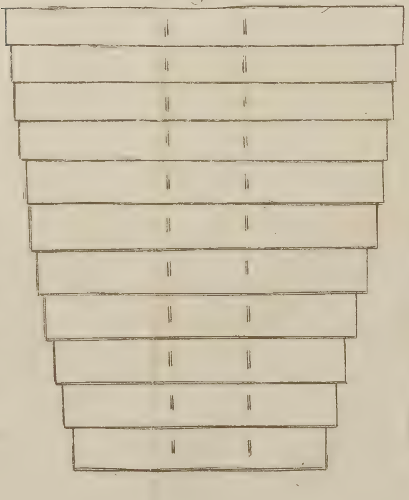
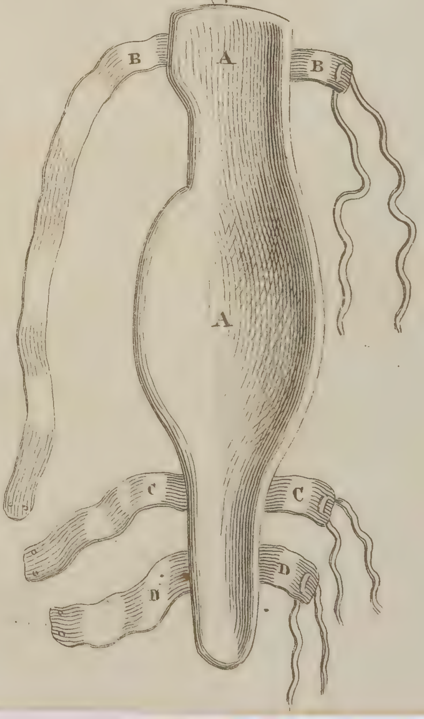


Fig 3



part, at ſmall intervals; and of ſuch length as to ſurround the leg, and to tie over the oppoſite ſplint.

FIG. 5.

REPRESENTS a bandage, ſuch as is deſcribed by Scultetus and Mr William Sharp; commonly uſed in St Bartholomew's hoſpital, London, for the dreſſing of fractured limbs.

FOR its appearance, when applied to the leg and thigh, ſee Plate III.

HAVING thus (with the ſame candour with which I wiſh my own propoſals may be tried) examined the ſeveral contrivances for accompliſhing retention of the fractured thigh-bone, which bade faireſt for ſucceſs,—and found them inadequate, inconvenient, or unſafe; with deference, I next proceed to propoſe and deſcribe a machine (Plate II. Fig. 1.) for performing this important buſineſs,—againſt which none of the objections produced above, or any others of equal weight, as far as experience or information have yet ſhewn, can fairly be made: which, I fondly hope, the candid experience of my ingenious brethren—will farther improve and confirm.

It has already been obſerved, that a proper and neceſſary reſiſtance to the conſtant contractile *niſus* of the femoral muſcles, now that the bone is fractured, can only be ſupplied by aſſuming two fixed points,—the one above, and the other below the fractured part; which are to be maintained at the ſame diſtance they held naturally, or immediately after extenſion and coaptation were duly accompliſhed.

THE *pelvis* offers itſelf as the moſt proper part for aſſuming the ſuperior fixed point, becauſe here the circulation and internal organs are protected from any preſſure that may be conſequent to doing ſo ; its ſituation alſo, as being above the neck of the thigh-bone, is an additional recommendation. For the inferior one,—the lower part of the thigh, or ordinary gartering place, for reaſons already alledged, is to be choſen. About each of theſe a *belt* or *circular* is applied.

THE circular which embraces the *pelvis*, occupies the ſame place where the top-band of the breeches in men is fixed, and with much the ſame ſtrictneſs; and reſembles it pretty much in ſhape : the other circular applies above the knee, with about the ſame tightneſs which the garters commonly have. Theſe conſtitute the two fixed points, and are the *baſis* of the reſiſtance to the muſcular contraction which we mean to produce;—their particular ſtructure and application ſhall be taught hereafter.

Graduating ſteel-ſplints, three or more in number, connect theſe circulars in ſuch a manner, that the intercepted portion of the thigh can be kept more or leſs extended at pleaſure, with abundant ſteadineſs and ſafety; and that even in ſpite of the motion which may be occaſioned by convulſive ſtartings, coughing, reaching to vomit, &c. for any length of time, and with equal facility and ſucceſs, whether, to obtain the relaxed ſtate of the muſcles, the patient lie on his ſide or back: and, what is of the laſt importance, this mode of dreſſing a broken thigh-bone, cauſes as little pain or uneaſineſs, as well when applying as afterwards, as any other *apparatus* whatever, that is likely to be productive of the ſmalleſt advantage. While all this is accompliſhing, the circulation is in no degree impeded or obſtructed; as any one, ever ſo little acquainted with the anatomy of the parts concerned, muſt know.

PREVIOUSLY to any further explanation of what I am inclined to regard as peculiar advantages, reſulting from the uſe of this machine for retaining the fractured thigh-bone,—it may not be improper to give ſuch a particular deſcription of its parts and mode of application, as may enable ſuch as chuſe properly to conſtruct and apply it.

THE largeſt circular, or that which ſurrounds the *pelvis*, (Plate II. Fig. 1. AAA,) conſiſts of a piece of thickiſh ſaddle-leather; its breadth, when intended for an adult, may be from three to four inches: in one end of it are three or four *ſtuds*, which have as many correſponding *holes* in the other end; by which it is buttoned or faſtened round the body. Theſe holes are continued backward, one after another, at ſmall diſtances. By this ſimple artifice its circle can be augmented or diminiſhed, ſo as to accommodate itſelf to *pelves* of different ſizes; or with different degrees of ſtrictneſs to the ſame *pelvis*.

THIS circular, all except its perforated part, and about a quarter inch on each edge,—is covered on the inſide with a flexible, thin iron-plate; ſuch as is ſometimes uſed by tin-plate-workers: it is provided with two obſcure joints at KK, in that part which anſwers to the back; theſe allow the circular to open and receive the body with the greateſt eaſe.

Over this iron-plate, the circular is lined with the ſofteſt buff or ſhamoy leather; between which and the plate, a thin layer of hair or wool is interpoſed: the lining ought to project, on both ſides over the leather half an inch or more; to prevent it in any degree from preſſing on the ſkin. The lining is ſtitched all round to the edges of the leather, to which the iron-plate does not extend.

It is moſt convenient, to throw the opening of this circular H to one ſide of the *os pubis*. After it is applied, to prevent it from moving upwards, (which the ſhape of the *pelvis*, and the preſſure made from below hinder from happening downwards); two thick ſtuffed ſtraps BB, fixed to its back part, paſs between the thighs from behind,—to tie, by means of their forked ends c c, to its fore part. As almoſt the whole reſiſtance to the ſhortening of the thigh, falls ultimately on theſe ſtraps; it is of conſequence that they be thick and well made: if they ſhould notwithſtanding, at any time, be found to ſit uneaſily,—a ſoft-folded cloth, or the like, can be put betwixt them and the ſkin.

From the above deſcription, it will now be evident,—that this whole circular is conſtructed on the very ſame principle, applied and ſecured to the very ſame places, and in the very ſame manner, as the common *ſpring-rupture-bandages*. The firſt idea of it, indeed, was ſuggeſted, by obſerving with what eaſe and immoveable firmneſs, a young man I had under my care for an *hernia inteſtinalis*, wore one of them;

during great exerciſe, and for a great length of time. The chief difference between the two is,—that this circular is much broader and thinner, and tied down to the *pelvis* by two thick ſtraps in place of one; that it might leſs incommode the patient while lying on his back, and the better divide and reſiſt the preſſure from below, and act as a fixed point without proving irkſome. It applies equally well, whether the body is naked,—or covered with ſhirt, waiſtcoat, breeches, *&c.*

The ſmall circular DD, or inferior fixed point, is exactly ſimilar to the large one in ſtructure, the tin-plate excepted; which, on account of its ſmaller diameter, was found to be unneceſſary. As was ſaid before, it applies round the inferior part of the thigh or gartering place, with the ſame, or ſomewhat leſs ſtraitneſs, than that with which the garters are commonly worn: it muſt not, however, be ſo ſlack, as to get over the *rotula* and knee-joint. Some folds of ſoft flannel are, previouſly to the application of this circular, put round the part to which it is to be applied.

By means of three or more *graduating ſteel-ſplints* DDD, paſſing between theſe two fixed points, thus eſtabliſhed, —to preſerve them at the requiſite diſtance from one another; the advantages derived from extenſion and coaptation are fully maintained, or perfect retention of the fragments is effected.

These ſplints muſt be ſufficiently long, to extend from the upper circular to the lower one; and to project over it about a hand-breadth.—They anſwer very well, when made about four or five eighth parts of an inch broad; and about one eighth part of an inch thick: that they may be rigid enough, to reſiſt any violence tending to ſhorten or otherways derange the limb and fragments; and at the ſame time ſo flexible, that they can readily be bended with the hand,—and made to aſſume any degree of curvature in any part of them, which may be found neceſſary.

Each ſplint has a hole or ſlit in its upper end,—about half an inch long, and one eighth of an inch in breadth; to receive the flat head of a ſtud planted in the upper circular,—in ſuch a manner as to allow of motion round its axis, for fixing the ſplint.

The inferior end of the ſplint paſſes thro' an iron-ſcrew-plate G, which is firmly riveted to the lower circular. The ſcrew has a flat broad head, that it may be eaſily turned with the fingers; and its point fitted to catch in ſome one or other of the impreſſions purpoſely made in the ſplint at ſmall intervals. It is eaſy to perceive that, by this means, the diſtance between the circulars can be regulated at pleaſure; and, when determined, firmly maintained.

It will now be alſo very apparent, that by making ſeveral ſuch graduating ſplints to paſs from the one circular to the other, at proper diſtances,—we form, as it were, a *breeches-thigh*; *rigid* enough to oppoſe unſurmountable reſiſtance to the muſcular contraction, or any ordinary accident tending to alter the coaptation of the fragments; which, notwithſtanding, is at the ſame time *dilatable* at pleaſure,—in every dimenſion.

As to the requiſite number of ſplints, I have from experience found three anſwer very well. One paſſes from the upper circular oppoſite to the *os pubis*, to the inferior circular at the internal and back part of the thigh, immediately above the knee-joint: another from oppoſite to the anterior ſpine of the *os ileum*, to the fore part of the inferior circular immediately above the *rotula*: a third from above, and a little back from the *acetabulum*, to the external and back part of the thigh, immediately above the knee-joint. If more of theſe ſplints ſhould be found or thought neceſſary, they can be occaſionally added in the intermediate ſpaces. For the appearance of a thigh dreſſed with the ordinary paſteboard ſplints, Mr Sharp's bandage, and the machine now deſcribed, —ſee Plate III. Fig. 2.

FROM the above deſcription, where, I hope, I have expreſſed myſelf intelligibly,—it will be evident, with what ſecurity and facility this machine may be employed; to effect retention of either thigh, or of both at the ſame time.

WHEN this machine is properly applied, all motion of the thigh on the *pelvis* is totally ſuppreſſed; which will be found to be a circumſtance highly favouring retention,—more eſpecially if the fracture is in, or near the neck of the *os femoris.*

As this method of retention is effectual, independent of the aſſiſtance of any other bandaging whatever. By making the ſplints to arch properly outwards, the neceſſary applications to all the thigh, or to wounds in any part of it, may be made,—without in the leaſt diſturbing the fragments, or paining the patient. Its extenſive uſe in the treatment of compound fractures of this part, requires no farther illuſtration.

THE advantages that may reſult from the uſe of this machine in the management of wounds of the thigh, with loſs of ſubſtance of the bone, (which may happen from various cauſes, particularly the different ſpecies of *caries*); will alſo be abundantly obvious: however, more fully to illuſtrate this obſervation, the following caſe is adduced, in which, if I am not much deceived, the patient would at leaſt have reaped much eaſe and relief from this mode of dreſſing.

“ A STUDENT, of the age of twenty, for ſeveral years had an ulcer with *caries* in the middle and internal part of his thigh, where the crural artery deſcends; the *caries*, from the thickneſs of the fleſh in this part of the thigh, was inviſible; neither could the ulcer be enlarged with the knife, or the bone cauterized, on account of the vicinity of the great artery,—ſo that all the medicines that were applied proved ineffectual. At length, in walking, without any external violence, the thigh was broken in this very part. Here again, we could neither enlarge the wound, or cauterize the bone, for the reaſons above mentioned; and although the bone was reduced, and a proper bandage applied,—yet it would never heal, and the patient led a miſerable life. It is therefore the duty of every one to conſider, how ſuch a fracture ſhould be treated, *&c**."

WHILE ſpeaking of the advantages of this machine, it may be mentioned;

---

* *Doctor James's medicinal Dictionary.*

that, by its uſe, the ordinary time of confining the patient to bed may be much abridged; for, with it applied, he may much ſooner venture to riſe than would otherwiſe be prudent.

Of Fractures of the Leg-bones.

THE difficulty of effecting due retention of the fragments of the leg-bones, after coaptation, is far from being ſo great as that of the fractured thigh-bone is ſhewn to be. However, if fractures here are much oblique, attended with wounds, or followed with high inflammation, ſuppuration, *&c.* the retentive part of their treatment is by no means eaſy to be accompliſhed. Any conſiderable loſs of the ſubſtance of the bones, ſtill renders this buſineſs much more difficult. Of this laſt aſſertion, the following caſe will furniſh an illuſtration.

A MAN, who, by a fall from a great height, had received a very bad compound fracture of the leg, with the *tibia* conſiderably protruded from the wound,—was put under the care of M. Vernier an able Surgeon. After coaptation, he found it impoſſible, by the ordinary bandages, to effect retention of the fragments; and gangrenous ſymptoms ſupervened in conſequence. After theſe were mitigated by proper remedies, M. Vernier again attempted extenſion; but, on account of the remaining ſwelling, this, in due degree, was found impracticable.

ON the twentieth day from the accident, the aſſiſtance of M. Coutavos of the French Academy of Surgery (by whom this caſe is publiſhed among the Academy's memoirs*) was obtained. Upon careful examination, M. Coutavos found a portion of the *tibia*, above five inches in length, almoſt quite detached. With the neceſſary precaution this was extracted, the fragments of the *fibula* were obſerved to paſs one another above four inches; the leg was ſhortened in the ſame degree; notwithſtanding the uſe of a machine invented and recommended for the retention of fractures, by M. la Faye; which will be hereafter mentioned.

---

* *Memoires de la Academie Royale de la Chirugie,* Tom. II. p. 415.

In this ſituation, the patient ſuffered ſuch intolerable pain, from the *ſtimulus* of the pointed fragments,—that M. Coutavos found it abſolutely neceſſary to procure extenſion of the leg, by ſome means or other; which he accordingly attempted, in the following laborious manner.

Lacs properly made, and paſſed under the patient's arms, between the thighs, and below the knee of the fractured leg,—were fixed to the head of the bed-frame, with a view to ſecure his body from yielding to the extending power; which was applied by means of another lac paſſed round the ancle,—which could be ſtretched at pleaſure, by means of an axis *in peritrochio* planted at the bed-foot. By gradually increaſing the extenſion in this manner, the limb at laſt regained its natural length.

After the patient had remained in this racking ſituation for fifteen days,—M. Coutavos ingenuouſly confeſſes, that, by the ſtrictneſs of the lac at the ancle, ſo great ſwelling of the foot enſued as made it abſolutely neceſſary to diminiſh the extending force; in conſequence of which, the leg was again ſhortened above an inch.

Both by experience and probability, I am encouraged to propoſe a machine (Plate II. Fig. 3. and 4.) conſtructed on the very ſame principle with the one recommended above for the thigh; which bids fair to effect retention of the fractured leg-bones with the greateſt poſſible eaſe and ſafety, where-ever it is by any means practicable.

In this machine, the graduating ſplints, made rather longer than the leg from the knee downwards, to which they are to be applied,—are connected at their lower extremities, by means of flat-headed vertible ſtuds or pins, to the ſoal of a ſhoe laced before; otherwiſe of the ordinary form (Fig. 4.): or with the quarter-heel protracted in the form of a half-boot (Fig. 3.), the better to embrace and lace round the ancle and inferior part of the leg.

The other extremities of the ſplints are fixed in the ſcrew-plates of a circular, exactly ſimilar to the inferior circular of the thigh-machine before delineated,—applied below the knee-joint.

The fore ſplint is made forked, or with an opening at the lower extremity (Fig. 5.); of a compaſs ſufficient to receive, but ſo as not, in the ſmalleſt degree, to preſs upon the fore part of the foot. This circumſtance contributes greatly to the ſecurity of the foot againſt lateral motion.

The intention of the ſhoe (in which ever of the two forms it may be made) in having an opening before, is,—that the foot may be lodged in it, with as little pain to the patient, or diſturbance to the fragments, as poſſible. When this is done, the opening is to be accurately ſecured with a lace. The foot is previouſly to be involved in a piece of ſoft flannel, or covered with a ſtocking-foot; as well for the ſake of ſoftneſs as warmth. At firſt, I made uſe of this machine conſtructed with a circular,—which fixed about the leg at the ancle, (Fig. 2.); but, from repeated trials, have found the ſhoe to anſwer better in every reſpect.

It will readily be underſtood, from the deſcription of this machine, how effectually, by its means, the retention of all compound, as well as of ſimple oblique fractures of the leg, may be effected with the greateſt convenience and ſafety;—by bending the ſplints a little outwards, it allows the wounds to be inſpected and dreſſed with the greateſt eaſe, in whatever part of the leg they may be ſituated;—by laying hold of the fore ſplint with one hand, the Surgeon can raiſe the leg, alter its ſituation when neceſſary, ſhift the dreſſings or bandages without the help of an aſſiſtant; and, what is of much greater conſequence, without giving the patient the ſmalleſt degree of additional pain. It ſeems to me highly probable, M. Coutavos would have aſſiſted his patient as much, or more, by this inſtrument, than the method he purſued.

In all ſimple, and in many compound fractures,—this inſtrument ſuperſedes the neceſſity of any other *bandage*, *ſoal-piece*, or *ſafe-guard*, to protect the limb from being incommoded by the preſſure of the incumbent bed-cloaths.

Another advantage attending the uſe of this machine, for the retention of the fractured leg-bones, not to be paſſed over in ſilence, is,—that, by its help, the patient is in a condition to leave his bed with ſafety, much ſooner than could otherwiſe be attempted. I had a young man, after a compound fracture of the leg, marching through the ſtreet with it, within four or five weeks from the accident. By it the leg may be altogether protected from the weight of the body.

THIS machine can very eaſily be rendered portable in the pocket by making a joint in each ſplint,—to allow only of ſide-motion; which, in no degree, impairs its retentive properties. Upon the whole, this inſtrument, tho' really a *ſtiff boot*, dilatable in every dimenſion,—may be regarded as a very portable, ſimple, and cheap *fracture-box*.

Of tranſporting Patients with Fractures of the Bones of their Thighs or Legs.

A CONSIDERATION of the exquiſite tortures which theſe unhappy people muſt ſuffer, who are obliged, by unavoidable neceſſity, to be tranſported, ſometimes in great haſte, and to a great diſtance, with fractures of their thighs and legs, either quite recent, or before their fragments are reunited,—in a very particular manner claims the joint ſuccours of humanity and art.

THE gallant warrior, whether acting by ſea or land, is peculiarly expoſed to calamities of this kind. M. la

Faye, an eminent Surgeon and member of the French Academy, who, it would appear, has been an eye-witneſs of the diſtreſsful ſcenes which this circumſtance occaſions,—can beſt paint them; I ſhall therefore, without farther apology, tranſlate part of a memoir wrote by him expreſsly on this ſubject.

" Of all men, who ſtand in need of the aids of ſurgery,—none deſerve it more than thoſe who continually expoſe their lives in defence of the ſtate.

" No ſpectacle can be more affecting, than the tranſportation of a number

---

* De tous les hommes qui ont beſoin des ſecours de la Chirurgie, il n'en eſt point qui méritent plus notre attention & nos ſoins, que ceux qui expoſent continuellement leur vie pour la défenſe de l'Etat.

C'eſt un ſpectacle touchant que celui d'une multitude d'Officiers & de Soldats dangereuſement bleſſés, qu'on tranſporte ber of wounded officers and ſoldiers from the trench or field of battle to a place for dreſſing them: I have always, in ſuch conjunctures, been much touched with the terrible pains and accidents which the very motion of the perſons employed to place the wounded in proper carriages, and of the carriages themſelves, occaſion to ſuch as have the bones of their legs or thighs ſhattered.

" It is difficult to move, and place in a carriage, people in this ſituation, without diſturbing the wounded parts; but, although this ſhould be accompliſhed, it is impoſſible that they can be driven

tranſporte de la tranchée ou du champ de bataille au lieu où l'on doit les panſer; j'ai toujours été touché dans de telles conjonctures, des douleurs affreuſes, & des accidens que le mouvement des perſonnes qui mettent les bleſſés dans les chariots, & celui de ces voitures mêmes, occaſionnent à ceux qui ont la jambe ou la cuiſſe fracaſſée.

Il eſt difficile de porter & de mettre dans une voiture, un malade qui ſera dans ce cas, ſans mouvoir la partie bleſſée;

driven for ſome leagues, or even half a league, without ſuffering the moſt acute pains from the ſhocks, which, in ſpite of all the bandaging about the fractures, at every movement, muſt diſplace the fragments, and make them grate on one another,—thus irritating parts extremely ſenſible and delicate. If the pains occaſioned by the tranſporting are lively, the conſequences are not leſs troubleſome.

"The ſplintered fragments, pricking and tearing the muſcles, nerves, *&c.* already

bleſſée; mais quand on le porteroit & qu'on le mettroit dans la voiture ſans cauſer aucune ſecouſſe au membre, il eſt impoſſible que la voiture qui tranſporte le malade à quelques lieues, même à une demi-lieue, ne lui cauſe des douleurs très-aiguës par des ſecouſſes, qui, malgré tout l'appareil mis ſur la fracture, déplacent à chaque inſtant les piéces oſſeuſes, & les font frotter les unes contre les autres, en irritant des parties extrêmement dêlicates & ſenſibles. Si les douleurs cauſées par le tranſport ſont vives, les ſuites en ſont tout auſſi fâcheuſes.

Les piéces oſſeuſes briſées, en piquant & en déchirant les muſcles, les tendons, les nerfs, les parties aponèvrotiques, already wounded, augment the ſwelling, inflammation and effuſions; and often occaſion mortification and gangrene in conſequence, which perhaps would not elſe have happened. Theſe accidents are ordinarily followed with fever, delirium, convulſive ſtartings; in one word, with general diſorder of the whole animal œconomy. Beſides this, the fragments may be ſo much diſplaced as to tear ſome conſiderable veſſel, and cauſe an hæmorrhage not to be remedied but by immediate amputation of the member; or, if not diſcovered in time, the hæmorrhage may prove mortal.

S [illegible] " People

---

vrotiques, déja bleſſées, augmentent le gonflement, l'inflammation & les dépôts; & par conſéquent occaſionnent ſouvent la mortification & la gangréne, qui peut être ne ſeroient pas ſurvenuës Ces accidens ſont ordinairement ſuivis de fiévre, de délire, de mouvemens convulſifs, en un mot, d'un déſordre général de toute l'œconomie animale: de plus les pièces oſſeuſes peuvent en ſe dèplaçant ouvrir quelque vaiſſeau conſidérable, & cauſer une hémorragie á laquelle

“ PEOPLE wounded in war, after having undergone the pains and dangers of a firſt tranſporting, are almoſt always expoſed to new pains and freſh dangers, greater than the firſt, on account of the changing their ſituation; becauſe of their number, or for other reaſons of which the detail is unneceſſary. I ſay, the dangers, to which a ſecond tranſporting expoſes them, are greater than the firſt; becauſe the ſick, having already ſuffered abundant-

ly,

---

laquelle on ne puiſſe remédier que par une prompte amputation du membre, ou une hémorragie mortelle; parce qu'on s'en ſera apperçu trop tard.

Les perſonnes bleſſées à la guerre, aprés avoir ſouffert les douleurs & eſſuyé les dangers d'un premier tranſport, ſont preſque toujours expoſées à de nouvelles douleurs & à de nouveaux dangers. plus grands que les premiers, par la néceſſité de les changer de lieu; ſoit à cauſe de leur multitude, ſoit pour d'autres raiſons dont le détail pas néceſſaire. Je dis que ces dangers auxquels un ſecond tranſport les expoſe ſont plus grands que les premiers, parce que les malades ayant déja beaucop ſouffert, ſont moins en état de ſupporter une nouvelle fatigue: & que d'ailleurs,

le

ly, are leſs in condition to ſupport freſh fatigue: and beſide, the motion of the carriage, in ſpite of all the precaution taken in ſuch caſes, may not only cauſe all the miſchiefs which I have already enumerated when ſpeaking of the firſt tranſporting; but may alſo, by the derangement of the fragments, and the irritation of the ſenſible parts, diſturb the ſuppuration already eſtabliſhed, or about to be ſo,—and thus occaſion a retroceſſion of the purulent matter; a circumſtance which is known ordinarily to prove fatal.

---

le mouvement de la voiture peut, malgré toutes les précautions qu'on prend en ces cas, leur cauſer non ſeulement les accidens dont nous avons fait le dètail au ſujet du premier tranſport; mais encore troubler, par le dérangement des piéces & par l'irritation des parties aponévrotiques, la ſuppuration déja établie, ou qui commence à s'établir,—& occaſionner le reflux de matiere purulente; reflux qu'on ſçait être ordinairement mortel.

“ The concern which one ought to take for the ſolace and preſervation of people wounded, while generouſly expoſing their life for the ſtate,—has excited me, in a particular manner, to inveſtigate means to prevent all theſe inconveniences. I am inſtigated with the greater ardour in this purſuit, ſince my labours, at the ſame time that they are uſeful to the warrior,—cannot fail, in like manner, to prove ſo to other claſſes of mankind, who follow perilous profeſſions and exerciſes; ſuch as, [illegible] or [illegible] maſons,

---

L’intérêt qu’on doit prendre au ſoulagement, & à la conſervation d’un grand nombre de perſonnes bleſſées en prodiguant généreuſement leur vie pour l’Etat, m’a engagé à m’appliquer d’une maniere particuliere aux moyens de prévenir tous ces inconvénients. Je me ſuis porté à cette recherche avec d’autant plus d’ardeur, que mon travail ne pouvoit être utile aux gens de guerre, ſans l’être auſſi aux perſonnes qu’une profeſſion périlleuſe, telle que celle de Maçon, de Couvreur, de Plombier; que certains exercices, comme par exemple, la chaſſe; ou qu’un malheureux hazard, peuvent mettre dans le cas d’avoir beſoin des mêmes ſecours.

Tome II. Memoires de l’Academie Royale de Chirurgie, page 403.

maſons, ſlaters, plumbers, lovers of the chace, *&c. &c.*"

M. LA FAYE then goes on to deſcribe a machine, which he recommends for the purpoſe of facilitating the tranſport of people in this unhappy ſituation. Without depretiating the invention of M. la Faye, I proceed to obſerve,—that the thigh and leg-machines, above deſcribed, will alſo very well anſwer the ſame purpoſe. They both can be applied without ſtripping the patient; and, when properly applied, very perfectly ſecure the parts againſt the ſmalleſt degree of alteration, even from the movement of a carriage.

IN ſhips of war, fractures of the limbs are no uncommon accidents: the difficulties of effecting retention of the fragments, while the patients remain on ſhip-board, but more eſpecially when it is found neceſſary to convey ſuch patients from one ſhip to another, or to hoſpitals a-ſhore,—muſt be fully greater than theſe which reſult from ſimilar accidents on land. Contrivances, ſuch as are mentioned above, are here likely to perform the moſt important ſervices.

Mr Wathen, an ingenious Surgeon, has deſcribed a machine, which he calls a *Conductor*; purpoſely invented to retain fractures of the leg-bones, where it is found neceſſary to tranſport the patient*. The leg-machine above mentioned is much leſs cumberſome than the Conductor, and perhaps gives greater ſecurity.

Of

---

* See his treatiſe, intitled the Conductor and containing ſplints.

Of Fractures of the *Tendo Achillis.*

THE *tendo achillis* is often fractured, by violent efforts of the extenſor-muſcles of the foot in dancing, jumping, *&c.* or divided with cutting inſtruments. The former caſe is analogous to ſimple, the other to compound fractures, of the bones.

Although there is no external wound, the fracture diſcovers itſelf immediately,—by the conſequent inability of ſupporting the body on the affected leg, with any degree of firmneſs.

In both caſes, the cure depends intirely on maintaining the foot in an extended poſture; ſo as that the parts of the divided tendon may be kept in exact oppoſition and contiguous, (in the ſame manner as the fragments of the bones,) till they are re-united*.

THE ſame method of cure is to be proſecuted, for partial diviſions of this tendon; and for deep tranſverſe wounds of the *gnoſtrocnemii* muſcles, whether immediately at, or near where they become tendinous.

VARIOUS methods of maintaining the extended poſture of the foot have been recommended by authors. Mr Gooch adviſes the following one:

"The ends of the divided tendon are to be brought and kept as near to-

---

* The method of preſerving them in contact by ſuture, ſeems now to be univerſally diſcarded.

gether as poſſible, by a favourable poſture of the limb; which is effected by bending the knee and heel, and extending the foot to ſuch a degree as is eaſy to the patient; keeping it ſo after dreſſing the wound by the following bandage,—firſt equalizing the ſmall of the leg, with ſoft well adapted compreſſes of linen cloth, fine tow, or quilting cotton, the latter of which is preferable to the others."

"BEGIN the bandage, by making a few circular turns of a roller of a ſufficient length and breadth about the thigh, juſt above the knee,—paſſing it round below, two or three times, in a figure of 8; deſcending then in regular and ſmall edgings, that it may be even and eaſy down to the ancle; making then a few turns, as about the knee, proceeding ſpirally to the toes: when, after making a few circulars, the roller is to be faſtened with a needle and thread, reflecting it from thence upon the ſoal of the foot, up the back part of the leg, to the circulars above the knee; ſewing it well there, and in the whole courſe of it, with a needle and thread; taking particular care, all the while, to have the leg kept in its true favourable poſture, by proper Aſſiſtants;—and, when this is done, it is neceſſary to have it reſted upon a pillow in bed, ſtrictly injoining the patient's own care to keep the limb quiet. The application of this bandage may be begun upon the foot at the toes; leaving a portion of the roller then to be reflected, fixed, and ſecured, as before deſcribed*."

ALTHOUGH there ſhould be no attending wound, this method by the roller-bandage muſt be exceedingly troubleſome and laborious; but where there is a wound, it muſt prove much more ſo;—beſides, the extenſion of the foot cannot be graduated without undoing almoſt the whole roller.

---

* See his caſes and remarks, Vol. II. p. 193.

THE celebrated M. Petit invented the following method, by which the extenſion can be regulated at pleaſure.

A SANDAL or ſhoe, with a low quarter-heel, is put upon the foot; from its back part a ſtrong ſtrap paſſes up the leg to the back part or hollow of the knee-joint, where a ſmall *axis in peritrochio* is placed, and ſecured by means of a broad circular,—ſo divided in its fore part, that the one half paſſes above, and the other below the knee. By turning the *axis*, which is provided with a handle, the ſtrap from the heel can be ſhortened or relaxed at pleaſure,

ſure, and conſequently the foot proportionally extended. If there is a wound, nothing impedes the neceſſary dreſſing*.

A METHOD almoſt ſimilar, though more ſimple, was practiſed in his own caſe by the late Profeſſor Dr Monro.— He made uſe of a foot-ſock, or ſlipper of tiking; open at the toes, to prevent them from being ſqueezed, when the extenſion was made by a ſtrap; which went from the back part of the ſock to fix above the calf, to a circular or calf-piece which ſurrounded the leg here, and laced before by means of pye-holes. The ſtrap was graduated by the helpof a buckle, in place of the *axis in peritrochio* of M. Petit. He wore this dreſſing for fifteen days, without moving the foot. To prevent too great extenſion of the foot,—at the end of ſix weeks, when he was obliged to go abroad, he wore a ſhoe with a very high heel. For greater ſecurity ſtill, for five months more, he had a piece of ſteel, which reached from the broad of the foot to the fore part of the leg; at both ends, this ſteel-machine was flat and ſtuffed, to give as little uneaſineſs as poſſible: it was ſecured by ribbands. A moſt complete cure was the reward of all this caution and ingenuity*.

---

* See Diſcourſe preliminaire ſur la traité des maladies des os. Tom. I. p. 20.

WHEN the fore-ſplint of the leg-machine is removed (Plate II. Fig. 4), the foot is very readily made to aſſume the extended ſituation repreſented by the pricked line; and as readily maintains that ſituation, if a ſtraight ſplint is made to paſs from the circular to the point of the ſhoe. By means of the ſcrew-nail in the plate of the circular,—it may eaſily be comprehended, how accurately the quantity of the extenſion of the foot may be graduated; and, when determined, maintained.

---

* See Edinburgh eſſays and obſervations, phyſical and literary. Vol. I. Article xxi.

UPON the ſuppoſition that the *Tendo Achillis* is fractured, this machine offers itſelf as a mode of dreſſing well adapted to its cure; ſecond to none, as far as I know,—in ſimplicity, ſafety, ſecurity and eaſe. By it, the time of confinement may be much abridged; in a very ſhort time, the patient may venture abroad with the greateſt ſafety,—in a carriage, on horſeback, or with crutches: by it, the toes are in no danger of being ſqueezed or cruſhed. Wounds attending fractures or partial diviſions of this tendon, or wounds of its muſcles near its commencement,—

can be dreſſed with the greateſt freedom.

If the quarter-leather of the ſhoe is thought ſo high as to be in danger of diſturbing the poſition of the tendinous fragments, it may be occaſionally cut lower.

EXPLANATION of PLATE II.

FIG. I.

REPRESENTS a machine for keeping the fragments of the thigh-bone *in ſitu*, after ſetting; whether the fracture is ſimple or compound, in the neck or body of this bone.

AAA. THE upper circular conſtructed as already deſcribed, which applies round the *pelvis*, like the top-band of a pair of breeches; it reſts on the ſame parts, and is fixed or buttoned in the ſame manner, by the ſtuds and correſponding holes H.

BB. Two ſoft ſtuffed ſtraps fixed to the back part of this circular; of ſuch length, as to paſs betwixt the thighs from behind forward,—to tie round the fore part of the ſame circular, by means of their forked extremities, CC; theſe effectually ſecure the circular from moving upward.—There are two obſcure joints, KK, in the back part of this circular, to facilitate its application;—however, it applies readily enough without them.

DD. The lower circular, which fixes above the knee at the gartering place.

EEE. Three graduating ſteel-ſplints, which extend from the one circular to the other. Their upper extremities are fixed to the upper circular, by vertible flat-headed ſtuds ſimilar to thoſe at FF; their lower extremities paſs through the iron ſcrew-plates GG, firmly riveted to the lower circular: the ſplints are provided with a number of impreſſions or holes, in which the ſcrew-nails, which paſs thro' the plates, catch.—By puſhing the ſplints from below upward, the diſtance between the circulars is increaſed, by turning the ſcrew-nails it is maintained; and conſequently, the intercepted part of the included thigh can be kept extended at pleaſure.—The ſplints are here fixed for the right thigh; the pricked lines on the other ſide ſhew, how they may be accommodated for the left one, or for both at the ſame time.

FIG. 2.

REPRESENTS a machine conſtructed on the ſame principle with Fig. 1. for effecting the retention of the fractured leg-bones.

AA. A circular which applies below the knee-joint.

DD. ANOTHER which fixes at the ancles.

EEE. THE graduating ſplints; ſimilar to thoſe of the thigh-machine, both in conſtruction and action.

FIG. 3. and 4.

REPRESENT the ſame machine; only the lower circular is exchanged for a half-boot or ſhoe of the ordinary form: they are open before, the more eaſily to receive the foot,—then to be ſecured with a lace. The ſide-ſplints fix to the heel of the boot or ſhoe, by vertible ſtuds; the fore-ſplint is forked at its inferior extremity, as in Fig. 5. by which means it includes the foot, but ſo as not to preſs upon it; it is fixed by ſimilar ſtuds, to the middle part of the ſoal.

The circular in Fig. 3. is provided with a jointed ſplint; to connect it, when neceſſary, to the thigh-machine.

The pricked lines in Fig. 4. ſhew the manner in which this machine is accommodated to the cure of the fractured *Tendo Achillis*: in this caſe, the fore-ſplint is not forked but ſtraight; it is fixed to the point of the ſhoe, by which means the foot is ſecurely and ſafely kept, in any requiſite degree of extenſion.

Explanation of PLATE III.

FIG. 1.

REPRESENTS the leg ſuppoſed to be fractured, dreſſed with the leg-machine above the paſte-board ſplints, and Mr Sharp's bandage; and elevated above the level of the body, for relaxing the muſcles.

FIG. 2.

REPRESENTS the thigh ſuppoſed to be fractured, dreſſed in the ſame manner as the leg:—by doubling up the matraſs, the body is raiſed above the general ſurface of the bed; by which means the knee can be bended to relax the muſcles.

PLATE II

Fig 1st

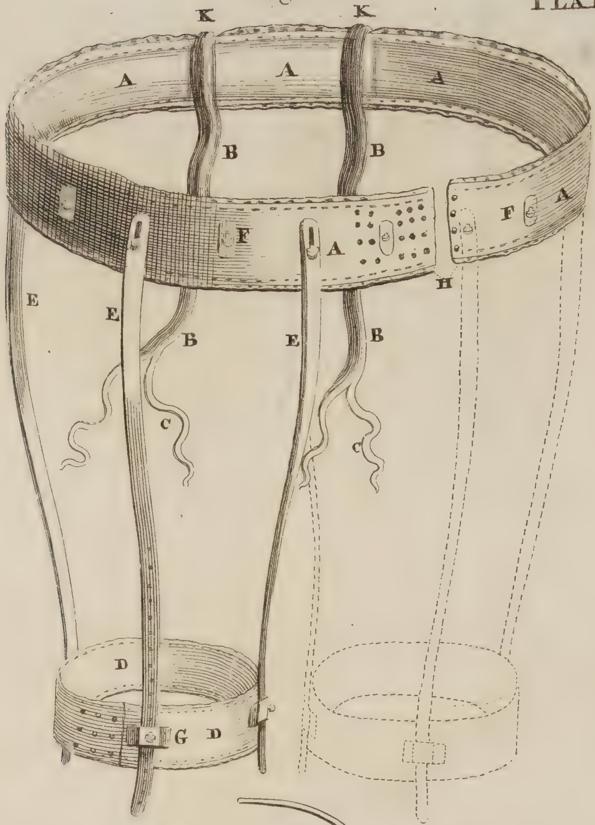


Fig. 2

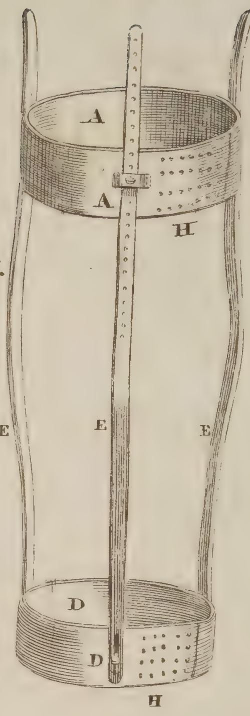


Fig 5.

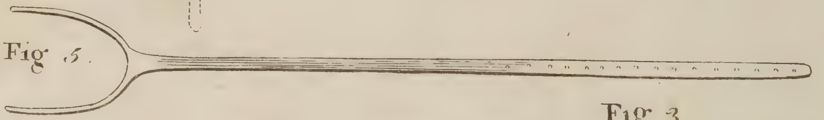


Fig 3

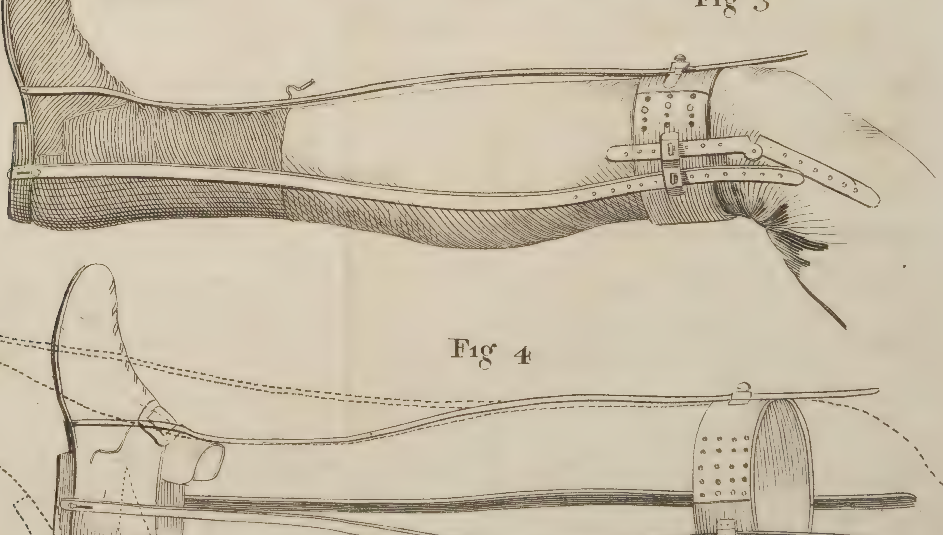
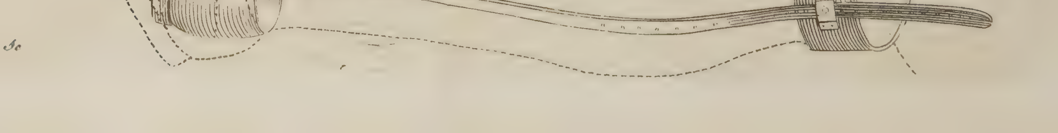


Fig 4



Begbie Sc

PLATE 3

Fig. 1

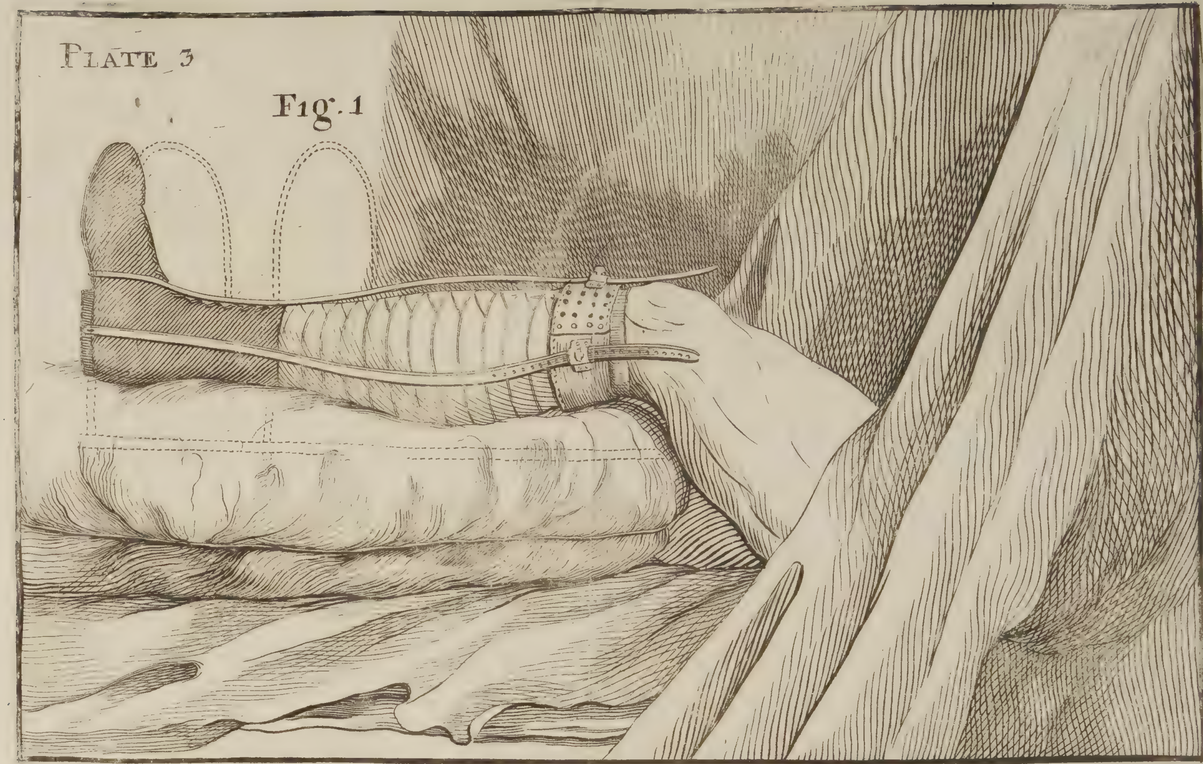
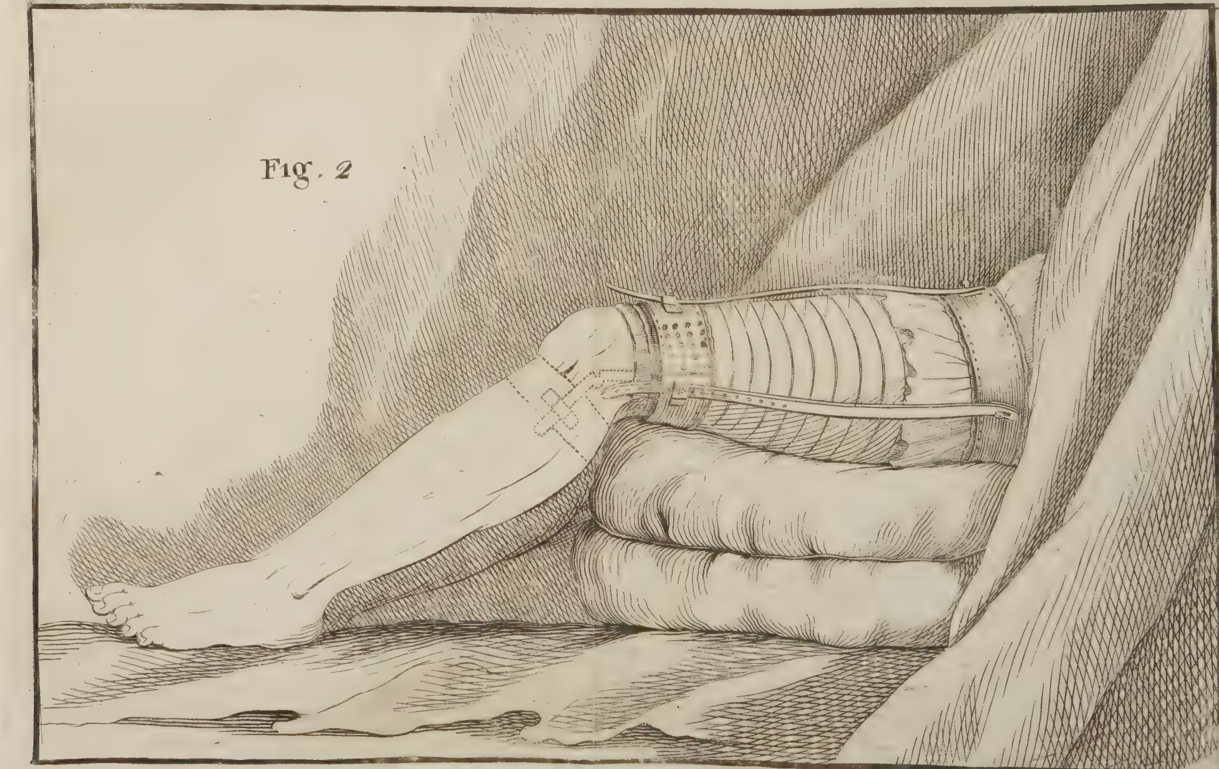


Fig. 2



Of RETRACTION *of the Skin and muſcular Parts, after Amputation of the lower Extremities.*

RETRACTION of the ſkin and muſcular parts, or rather its very troubleſome conſequences after amputation of the inferior extremities, particularly when inſtituted in the thigh,—has (notwithſtanding the double inciſion) been much complained of by ſurgeons of the greateſt abilities and experience; and various methods of redreſs and prevention have been propoſed.

1. *The Croſs-Stitch.*—To place this matter in a proper light, I beg leave

to tranſcribe a paſſage from an author*, whoſe writings reflect on himſelf, and his profeſſion, the greateſt luſtre and honour.

“ It muſt be confeſſed, however, that notwithſtanding we derive ſuch benefits from the double inciſion; the contractile diſpoſition of the muſcles, and perhaps of the ſkin itſelf, is ſo great, that in ſpite of any bandage they will retire from the bone, eſpecially in the thigh,—and ſometime render the cure tedious.

To remove this difficulty, I have lately, on ſome occaſions, made uſe of the croſs-ſtitch; which I would adviſe to be applied in the following manner, in amputations of the thigh.

“ Take a ſeton-needle, and thread

---

* Mr S. Sharp’s Critical Inquiry, p. 266.

it with about eight threads of coarſe ſilk; ſo that, when they are doubled, the ligature will conſiſt of ſixteen threads, about twelve or fourteen inches long: wax it pretty much, and range the threads, ſo that the ligature may be flat, reſembling a piece of tape; after which, oil both it and the edge of the needle: the flatneſs of the ligature will prevent its wearing thro' the ſkin ſo faſt as it would do if it was round, and the oil will facilitate its paſſage: then carry the needle through the ſkin, at about three quarters of an inch from the edge of the ſtump, and out again on the inſide at about half an inch from the edge of it; after which it muſt be paſſed through the oppoſite ſide of the ſtump from within outward, exactly at the ſame diſtance from the lips of the wound; this done, the ſilk is to be tied in a bow-knot. With another needle and thread of ſilk, the ſame proceſs is to be repeated; in ſuch manner, that the ligatures may cut each other at right angles. If it is a large thigh, the lips of the wound may be made to approach each other ſo near, as that the diameter of the wound may be about two or three inches long;—but in this, as in all other wounds, the approximation of the lips will depend upon the laxneſs of the ſkin, and the quantity preſerved by an artful double inciſion;—for the ſkin muſt not be drawn together ſo tight as to put it upon the ſtretch, leſt it ſhould bring on an inflammation and pain.

"THE manner of applying the croſs-ſtitch, after an amputation of the leg, has nothing particular in it; only that the threads muſt be carried between the *tibia* and *fibula*, rather than directly cover the *tibia*;—and before the ſkin is drawn over the end of the ſtump, it will be proper to lay a thick doſil of lint on the edges of the *tibia*, in order to prevent them from wounding the ſkin.

"I HAVE adviſed the ſkains of ſilk to be tied with a bow-knot,—that in caſe of a hæmorrhage they may be undone, in order to diſcover the veſſel more eaſily; and alſo if any tenſion ſhould enſue, that they might be looſened for three or four days,—and tied again when the ſuppuration comes on, and the parts are more at liberty.

"PERHAPS it may be objected, that the double inciſion is of itſelf ſufficient for anſwering the ends propoſed by this meaſure: but whoever is converſant in this branch of practice muſt know, that notwithſtanding the lax ſtate of the ſkin and muſcles, at the time of the operation,—yet ſome days after they fall conſiderably back from the bone, and in the thigh particularly; ſo much that no bandage will ſuſtain them. The conſequence of which is a proportionable largeneſs of wound, a tedioufneſs of cure, and ſome degree of pointedneſs in the ſtump. It may be obſerved too, that the ſtrictneſs of bandage for ſupporting the ſkin and muſcles of the thigh, is not only painful,—but in all probability may obſtruct the cure of the wound, by interrupting the nutrition; for it is certain, that by long continuance it often waſtes the ſtump: and I am jealous it may alſo be acceſſary to thoſe abſceſſes, which ſometime form among the muſcles in different parts of the thigh.

" THE queſtion then remaining is, Whether theſe ſtitches will ſupport the ſkin and muſcles more effectually than bandage, without producing ſome new evil; a point which can only be decided by experiment? It is true, that this very method was followed by ſome of our anceſtors;—and the objections to it have abſolutely prevailed over the arguments in favour of it. I cannot help imagining, that caprice may have had more ſhare in utterly diſcarding this method, than reaſon and obſervation;—for it is particularly ſaid by ſome of the moſt able and candid practitioners, to have ſucceeded miraculouſly: and as the inflammation and ſymptomatic fever excited by it, were always relievable by cutting or looſening the ſtitches,—there does not ſeem to have been reaſonable grounds for wholly giving up ſuch great advantages.

“ But if the objections to it were of force, when the ſingle inciſion was practiſed; they diminiſh exceedingly, now that we perform the operation by the double inciſion. For though the double inciſion does not directly prevent the withdrawing of the muſcles from the bone, it abates the degree of it ſo much,—that they can ſuffer the ſtitches without incurring either inflammation or pain; to which they are much more liable after the ſingle inciſion. It muſt be remarked, however, that they draw with that ſtrength as to make the ſtitches wear through the ſkin and fleſh in twelve or fourteen days; but this is done ſo gradually, that it cauſes very little pain or inflammation: and though they conſequently come off with the dreſſings, yet by this time the ſkin and muſcles are fixed; and a ſlight bandage will be ſufficient to maintain them in the ſame poſition.

"I CONFESS, however, that theſe ſtitches are an additional pain to the operation, though,—perhaps, not ſo bad as one is apt at firſt to ſuggeſt; for the mere paſſing a large ſeton needle through the fleſh, without making a ſtricture, is very bearable in compariſon of a tight ligature: but, whatever be the increaſe of the pain for the preſent, the future eaſe in conſequence of it is an ample compenſation: therefore, if I am not miſtaken, there is ſtill another conſideration, of much higher importance than any I have mentioned; and that is, a leſs hazard of life.

"For the ſymptomatic fever, and the great danger of life attendant upon an amputation,—does not ſeem to proceed purely by the violence done to nature, by the pain of the operation, and the removal of the limb; but alſo, from the difficulty with which large ſuppurations are produced: and this is evident from what we ſee in very large wounds, that are ſo circumſtanced as to admit of healing by inoſculation, or, as Surgeons expreſs it, by the firſt intention: for in this caſe we perceive the cure to be effected without any great commotion; whereas the ſame wound, had it been left to ſuppurate, would have occaſioned a ſymptomatic fever, *&c.* But, in both caſes, the violence done to nature is the ſame; whether the wound be ſewed up, or left to digeſt.

" UPON this principle we may account for the diminution of danger, by following the method here propoſed: becauſe, as the ſtitches have a power of holding up the fleſh and ſkin over the extremity of the ſtump, till they adhere to each other in that ſituation; they actually do, by this means, leſſen the ſurface of the wound, and, in conſequence, the ſuppuration,—

and, in conſequence of both, the danger reſulting from the ſuppuration.

"Perhaps, it may not readily be underſtood, how a wound can, by any managment, be ſuddenly ſo much diminiſhed: but it may be better conceived, if we reflect on the manner in which a wound heals. For, in this way we accompliſh immediately by art, what requires a length of time to be effected in the ordinary methods of nature; and with this advantageous circumſtance, that when the wound is reduced into ſo ſmall a compaſs, the ſkin is in a looſer ſtate than when it has not been kept forward by the ſtitches; in conſequence of which, the cure will be more quickly compleated: for the looſer the circumjacent ſkin is, the leſs will be the cicatrix; and cicatriſation is by much the ſloweſt proceſs in healing. It appears then, from the repreſentation I have given,—that, by this method, we not only bring the wound to a ſmall compaſs in a leſs time; but alſo give it a ſtronger tendency to heal intirely."

There is ſome reaſon to ſuſpect, that the croſs-ſtitches not only give additional pain; but that ſome portion of the purulent matter, which neceſſarily adheres to them, will contract a degree of acrimony: and remaining on the very ſenſible muſcular ſurface of the ſtump, as a *ſtimulus*,—may increaſe both the retraction of the ſkin and muſcles, and the diſcharge.

The ordinary method of dreſſing ſtumps is the beſt calculated, which can poſſibly be imagined, very much to aſſiſt and increaſe the natural retraction of the ſkin and muſcles. I here chiefly allude to the pernicious cuſtom of uſing croſs-compreſſes; and to the ſtill more pernicious practice of making numberleſs turns over them, with long unmanageable roller-bandages. Both theſe act principally againſt the retracting, yielding and unſupported circumference of the ſtump; and forcibly induce the pyramidal form, which it is the operator's buſineſs, by every means, to prevent.

With a view to remedy, as much as poſſible, theſe inconveniencies, and to fulfil the intention of the croſs-ſtitches,—it is propoſed, immediately after amputation, ſuppoſe in the thigh, to apply round it, either equal with, or a very little higher than the termination of the ſkin, a properly ſhaped piece of ſtrong linen, leather, or the like, ſpread with adhæſive plaiſter; extending from this termination upwards upon the thigh five, ſix, or ſeven inches, according to the ſize of the patient, (Plate IV. Fig. 1. AA.) To the inferior edge of this plaiſter, which correſponds with the termination of the ſkin, ſtraps of ſtrong tape are to be ſewed at proper intervals, (Fig. 3.)

The thigh-machine (whoſe upper circular may be fixed about the *pelvis* previous to the operation) is to be applied in the ſame way as already taught: the lower circular, when intended for this purpoſe, ſhould be about ſix or ſeven inches broad, (Fig. 1. BB.); that it may project over the ſkin and muſcles about three or four inches, while, at the ſame time, it gently ſupports them. To prevent the *pus* from penetrating, it muſt be covered with wax-cloth. The tape-ſtraps, which are ſuppoſed to be included within the circular, are ſeverally to be drawn, till the ſkin is brought to its natural tone as nearly as can be aſcertained; they are then to be reflected from within outwards over the projecting edge of the circular, and ſecurely pinned to the wax-cloth, (Fig. I. c.). The dreſſing is finiſhed, by ſimply covering the included ſurface of the ſtump with lint, *&c.*

THAT very conſiderable reſiſtance will be made to the retraction by this method of dreſſing, is demonſtrable by the following experiment. A ſlip of linen, an inch and half broad, and ſix inches long, ſpread with the adhæſive plaiſter of the ſhops,—was applied longitudinally to the thigh; it adhered with force ſufficient to ſuſpend, by its inferior extremity, a weight of above ſix pounds: one of ſeven pounds made it yield and glide along.

When a ſtump is dreſſed in the way now recommended, it is confined to the ſame level with the body, and cannot be raiſed up at the will of the patient; which, though a common, ſeems to be a very miſchevious practice,—conducing greatly to increaſe the retraction, by throwing many of the muſcles into action.

This method of dreſſing ſtumps applies with equal facility,—whether amputation is performed below the knee at the ordinary place, or above the ancle-joint. In the former caſe, the circular of the leg-machine (made of proper breadth and covered with wax-cloth) is to be connected, by means of two jointed ſplints (Plate IV. Fig. 1. EE, Fig. 2. 6. 7.), to the inferior circular of the thigh-machine; in the latter caſe, the leg-machine conſtructed as in Plate II. Fig. 2. is to be uſed;

the other parts of the dreſſing are the ſame as ſhewn above.

MORE effectually to bring the ſkin over the ſurface of the ſtump, as intended by the croſs-ſtitches; the ſtraps of the plaiſter, in place of being reflected over the edge of the circular, (as in Fig. I. c.),—by means of a piece of iron ſhaped as in Fig. 5. applied over the opening of the circular, they may be made to converge, as it were, into a point or *focus* in a line paſſing thro' and parallel with the *axis* of the ſtump; and there tied ſo as to make the reſiſtance wanted.

BY this method of preventing retraction, or the falling back of the ſoft parts from the bone,—is by no means underſtood, that the ſkin is to be forcibly ſtretched beyond the natural degree of its tenſion; to preſerve this degree of tenſion is all that is aimed at. As Mr Sharp alledges, that the ſkin and muſcles are ſo fixed in about fourteen days from the operation, as to be in no danger of ſuffering further retraction,—the moſt ſimple dreſſings may then be ſubſtituted.

2. *Preſerving flaps of the ſkin and fleſh, or what is called the flap-operation.*—The flap-method of amputation was propoſed by an Engliſh Surgeon named Lowdham; alſo by Sabourin and Verduin, Surgeons of great eminence,—the former of Geneva, the latter of Amſterdam. Improvements have ſince been added, at different times, by Meſſrs Ravaton, Vermale, la Faye, o'Halloran.

A MACHINE, to effect compreſſion of the flaps better than was done by the *Soutien* of Verduin, is deſcribed and recommended by M. la Faye*. It will now be readily underſtood, from what is ſaid above, how the flaps may be ſuſtained over the ſtump in the moſt perfect and equable manner poſſible, at the ſame time, and by the ſame means propoſed for preventing the receding of the ſkin and muſcles after amputation in the common way;—only with this difference, that after the ſtraps are reflected and pinned, and the flaps diſpoſed in the moſt proper manner, a quantity of ſoft lint is to be ſuperimpoſed,—ſufficient to fill the opening of the circular, ſo as to equal its brim: the dreſſing is finiſhed by accurately applying a thin piece of wood, (with a ſtrap or two fixed to its back part), ſo ſhaped as to cover the mouth or opening of the circular, (Fig. 4.); by its ſtraps it is to be ſecured to the graduating ſplints. By increaſing or diminiſhing the quantity of lint, or tightneſs of the ſtraps by which the piece of wood is tied, it is evident,—that any degree of the moſt equable compreſſion may be obtained.

---

* Memoires del Academie Royale de Chirurgie, Tom. II. p. 243.

Although the complex ſtructure of the machine recommended by M. la Faye will, with many, be a ſufficient reaſon for not employing it: ſuppoſing it equally ſimple in its parts with the one propoſed above, yet it muſt yield to it, in ſo far, that while, on the one hand, by this laſt, a preſſure of the moſt equable kind is made upon the flaps,—on the other hand, the retraction of the ſkin and muſcles is oppoſed by a very conſiderable force; and much greater ſecurity againſt hæmorrhage, at the ſame time, is obtained; as will be ſhewn hereafter. Any one, who may take the trouble of comparing the two methods, will eaſily perceive the truth of this aſſertion.

Of reſtraining Hæmorrhage, after Amputation of the lower Extremities, by topical Compreſſion.

OF all the topical applications hitherto employed to reſtrain hæmorrhage in general, and that conſequent to amputation in particular, (the ligature excepted) *ſpongy or fungous ſubſtances* have juſtly obtained the preference*.—There is however ſome reaſon to believe, that thoſe ſubſtances

---

* I made uſe of ſpunge for the ſtoppage of hæmorrhage in all caſes indiſcriminately, for near three years, in which time there were nineteen amputations of the extremities, fourteen of which were of the thigh; and it never failed except in one inſtance.—*Caſes in Surgery with remarks, part firſt, by* Mr Charles White.

owe this preference, not to any extraordinary aſtringent powers peculiarly inherent in themſelves: by which they may be ſuppoſed capable either to coagulate the blood in the bleeding veſſels, or to conſtringe the orifices of the veſſels themſelves. As they muſt always be aſſiſted by conſiderable compreſſion, before they produce any effect; it is more likely that their action is in a great meaſure mechanical: their peculiar elaſtic ſtructure very well qualifies them to act in this manner.

Properly to ſupport theſe fungous ſubſtances, when applied over the bleeding veſſels; or, cloſely to retain them there, till the veſſels, by their natural elaſticity, contract, or till their ſides concrete, or both;—ſeems to be the chief difficulty attending their uſe: this obſervation may be illuſtrated by the following caſes, publiſhed by Mr White of Mancheſter, an expert and able Surgeon.

"W. Smith, affected with hectic fever and its concomitants, from ulcers of the ancle, attended with *caries*, and in conſequence extremely reduced; had his leg amputated in the uſual place below the knee. Upon ſlackening the tourniquet, the arteries bled freely. I covered the whole ſtump with pieces of dried ſponge, applied over theſe the common dreſſings; and retained them on by no tighter a bandage, than what was juſt neceſſary to keep the ſponge in contact with the mouths of the divided arteries: the tourniquet was let looſe, in about fifteen minutes after the operation. I now recollected, that I had omitted to cut the interoſſeous ligament: but as the ſtump was dreſſed, and the patient in bed; I was, for the preſent, unwilling to diſturb him. In about an hour an hot fit came on, and an eruption of blood ſoon after ſucceeded; but it was immediately ſuppreſſed, upon the application of the tourniquet by a perſon whom I had left in the room. I returned ſoon after, and, removing the dreſſings, diſcovered, as I expected, —that the effuſion of blood proceeded from the *tibialis antica*. I, therefore, with a knife, divided the interoſſeous ligament; and re-applying the ſponge, in about a minute afterwards I ſlackened the tourniquet. It appeared, however, that the ſponge had not time enough to ſecure its ſituation; for this reaſon it was neceſſary again to tighten the tourniquet. The ſponges, which were ſaturated with blood, were removed; and I applied freſh pieces to the extremities of the veſſels: preſſing that which I had placed upon the *tibialis antica*, tightly down between the ſeparated edges of the interoſſeous ligament. A ſecond piece was applied over this, and a whole undried ſponge was placed ſo as to cover both; theſe were all retained by four croſs-ſlips of good ſticking plaiſter: and, to render them ſtill more ſecure, I took a double-headed bandage, bended the knee,—and bringing the middle of it to the extremity of the ſtump, paſſed each end ſeveral times over the knee and back again; making the compreſſion ſomething tighter than uſual. I did not however turn it round any part of the limb; circular bandages, when applied too tight, being frequently prejudicial. In leſs than an hour the tourniquet was intirely ſlackened; and I had no farther occaſion to repeat its uſe, not the leaſt effuſion of blood ſucceeding. The great heats under which my patient laboured, the thinneſs of his blood, and exceſſive quickneſs of his pulſe,—made me think all the precautions I had taken neceſſary. As I was convinced the ſponges muſt have ſufficiently ſecured themſelves, I removed the tight bandage early the next morning; and the ſponges were taken away a fortnight after the amputation,—not the leaſt difficulty, or leaſt effuſion of blood, attending their removal."

" THE ſponge never failed me, except in one inſtance: which was after amputating the thigh of a young gentleman, who had a white ſwelling in the knee, attended with conſtant convulſive twitches in his leg and thigh, ſo great as to raiſe the limb every five minutes from the pillow; theſe twitches continued after the operation, and would never allow the ſponge to adhere. After ſome ineffectual trials of it, I ſecured the femoral artery with the needle and ligature; and the patient went on very well for three weeks, ſo as to be able to ſit up many hours in a day, to read and write, and play on the flute: but, about the expiration of that time, he was ſeized with the ſymptoms of the locked jaw, and died in a few days*."

In all caſes of amputation in the lower extremities, the ſponge may be kept moſt accurately applied to the orifices of the veſſels, with any degree of force,—by the very ſame *apparatus* recommended above for the flap-operation. It would very probably have ſucceeded in both the caſes above mentioned, particularly in the latter one; becauſe it infallibly confines the limb, as was before obſerved, to the ſame level with the body: and conſequently would have prevented the convulſive twitches from raiſing it from the pillow, and thereby defeating the action of the ſponge. I am perſuaded, the veſſels of the leg might be thus ſtopped by compreſſes of lint only, without the aſſiſtance of the ſponge.

---

* See his caſes in ſurgery, with remarks, part firſt, p. 151. and 168.

The oozing of blood from the general ſurface of the ſtump, which ſometimes happens,—may be ſtayed by the very ſame means propoſed for the flap-operation, and for the retention of ſpongy or fungous ſubſtances over the bleeding arteries.

Of FRACTURES of the PATELLA.

THE *patella*, *rotula*, or *knee-pan* is ſometimes, though very unaccountably, fractured ina longitudinal direction with reſpect to the leg. This bone, however, for very evident reaſons, is much more frequently fractured in a tranſverſe direction.

THE cure of tranſverſe fractures of this bone is rendered very difficult by its flat roundiſh form, by the neighbourhood of the knee-joint; but eſpecially by the contraction of the very ſtrong extenſor-muſcles of the leg, which are attached to its upper edge: ſometimes it is ſo unequally divided, that only a very ſmall fragment adheres to the tendons of the extenſor-muſcles; a circumſtance which adds very conſiderably to the difficulty of retention.

LIKE all other fractures, the cure here is to be attempted by approximating and keeping contiguous the fragments of the bone; to effect which, the extended poſture of the leg is abſolutely requiſite.

M. PETIT, to effect retention of the fragments of the *patella*, preſcribes as many compreſſes of various ſhapes, and as many bandages and rollers, of different lengths and breadths, as would require a great meaſure of patience properly to apply. The retentive powers of all ſoft pliant bandages, however dexterouſly they may be applied,—are here feeble, and for the moſt part inadequate: and when employed during the whole proceſs of the cure, (which I have known eight weeks inſufficient to obtain,) the patient muſt be confined to bed; at leaſt, the affected limb muſt be moved with the greateſt caution.

FROM the inſpection of Fig. I. Plate 4. it will be evident,—how perfectly the retention of tranſverſe fractures of this bone may be accompliſhed; by the circular of the leg-machine, and the inferior one of the thigh-machine, connected laterally together by the jointed graduating ſplints EE. The back edges of theſe ſplints are to be turned forward, to prevent all flexion of the knee-joint: proper compreſſes of folded linen are alſo to be interpoſed betwixt the circulars and knee-pan, eſpecially betwixt it and the upper one. The graduated connecting ſplints allow the circulars to be more or leſs approximated, as may be neceſſary.

It will be obſerved, that as all motion of the knee-joint, by this mode of retaining the fractured *patella*, becomes impoſſible; the neceſſity of confining the patient to bed for any length of time, is ſuperſeded: on the contrary, he may move about with a good deal of ſafety after a few days. The circulars require to be applied with much leſs ſtrickneſs, than the roller-bandages commonly employed.

It will alſo be obſerved, how well the retention of longitudinal fractures of this bone, (if at any time ſuch ſhould happen) can be effected; by interpoſing compreſſes betwixt it and the lateral connecting ſplints.

If the fragment adhering to the tendons of the extenſor-muſcles is ſmall, and it is thought neceſſary to make uſe of preſſure along the courſe of the *rectus-femoris*-muſcle, with a view to obtain a temporary diminution of the contractile power; this may be eaſily, conveniently, and effectually accompliſhed: by adding the upper circular and graduating ſplints of the thigh-machine, as before taught; and interpoſing compreſſes with any requiſite degree of force betwixt the thigh and fore ſplint, along the courſe of the muſcle above named.

The method of cure here propoſed for fractures of the *patella*, will anſwer equally well,—if at any time the ligament connecting it with the *tibia*, is ruptured.

Explanation of PLATE IV.

FIG. I.

REPRESENTS the body from the top of the *pelvis* downwards.—The right leg is ſuppoſed to be amputated.

THE right thigh repreſents the method of applying the thigh-machine, to prevent retraction of the ſkin and muſcles, *&c.* after amputation.

AA. PART of the adheſive plaſter which ſurrounds the thigh, appearing above the circular.

BB. THE inferior circular made purpoſely ſomewhat broader than common; gently to ſupport the ſoft parts, and to project ſome inches over them.—It is ſuppoſed to be covered with wax-cloth; to prevent the matter diſcharged by the ſtump, from penetrating.

C. The tape-ſtraps which come from the inferior edge of the adheſive plaſter, included within the circular; and reflected over its edge from within outwards.—They are ſuppoſed to be ſecurely pined all round to the wax-cloth, which covers the circular.

DD. The two ſtuffed ſtraps, which are fixed to the back part of the upper circular (Plate II. Fig. I. BB); and paſs betwixt the thighs from behind forward,—tied by their forked extremeties, to its fore-part.

The left limb ſhews how the thigh and leg-machines may be connected by the jointed ſplints EE, ſo as to allow motion of the knee-joint. The fore-ſplint is here ſuppoſed to be abſtracted from the thigh-machine; by which means, and by the help of a joint near the head of the lateral ſplint which extends up the inſide of the thigh to the *os pubis*,—motion of the thigh on the *pelvis*, is alſo permitted: as are alſo flexion and extenſion of the foot on the leg, ſo that it will be evident the patient is ſtill at liberty to walk. In caſes of weakneſs of the whole limb, or of a particular joint, or before the *callus* is ſufficiently confirmed after fracture; the weight of the body may almoſt be totally ſuſtained by this contrivance, and prevented from falling on the limb.

FIG. 2.

REPRESENTS the leg, and part of the thigh, in a ſide view; to ſhew the method in which the lateral jointed ſplints connecting the two machines are fixed to the adjacent circulars, ſo as not to impede the motion of the knee-joint.

FIG. 3.

REPRESENTS the ſhape which the ſticking-plaſter to be applied round the thigh or leg, to prevent retraction of the ſkin, *&c.* may have; with the tape-ſtraps affixed at ſmall intervals to its inferior margin.

FIG. 4.

REPRESENTS a thin piece of wood, with a ſtrap fixed to its back part to ſecure it to the ſplints; when applied over the opening or mouth of the circular, in the flap operation, *&c.*

FIG. 5.

REPRESENTS a piece of iron with three branches, to be applied over the mouth of the circular; for the purpoſe of making the ſtraps from the plaſter converge into a point, over the centre of the ſtump.

FIG. 6. and 7.

REPRESENT the jointed connecting ſplints, in two views.

FIG. 8.

REPRESENTS a ſide view of a ſingle and double iron ſcrew-plate, provided with flat headed ſcrew-nails; to catch in the impreſſions of the ſplints, as they paſs through the plates, when riveted upon the circulars.

FIG.

PLATE IV

Fig 3

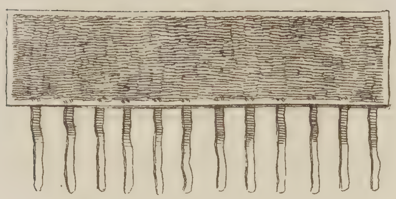


Fig 1

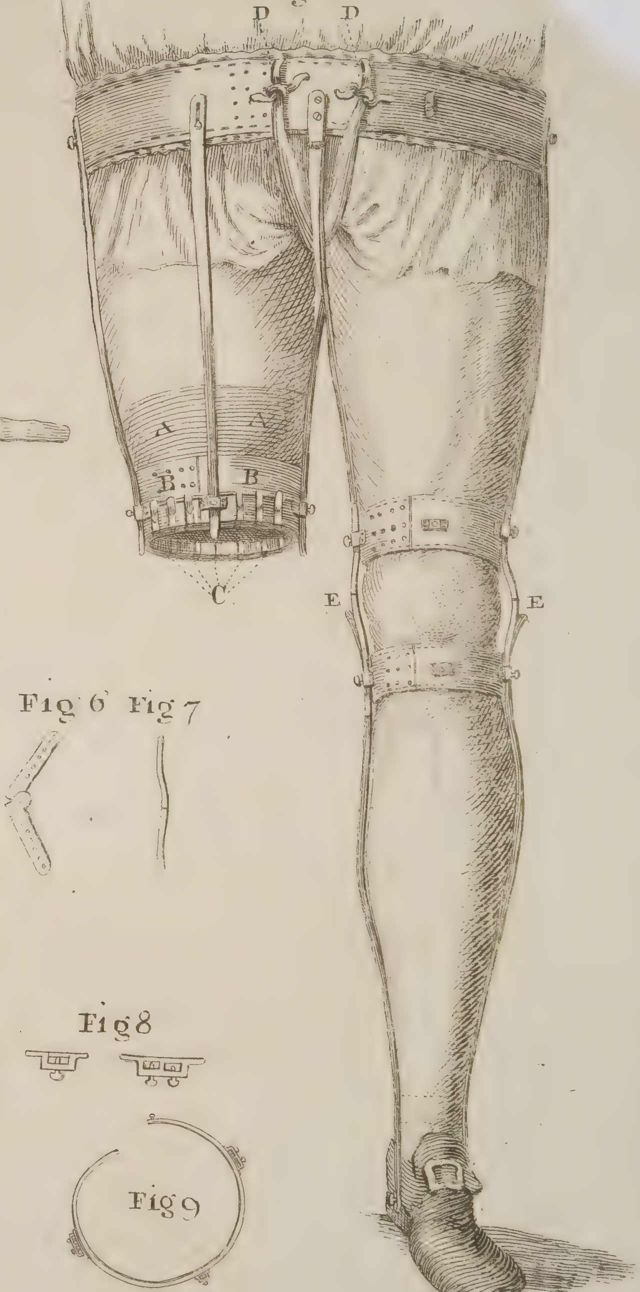


Fig 5

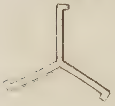


Fig 4

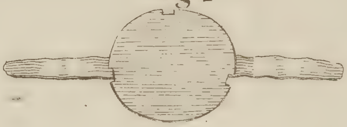


Fig 2

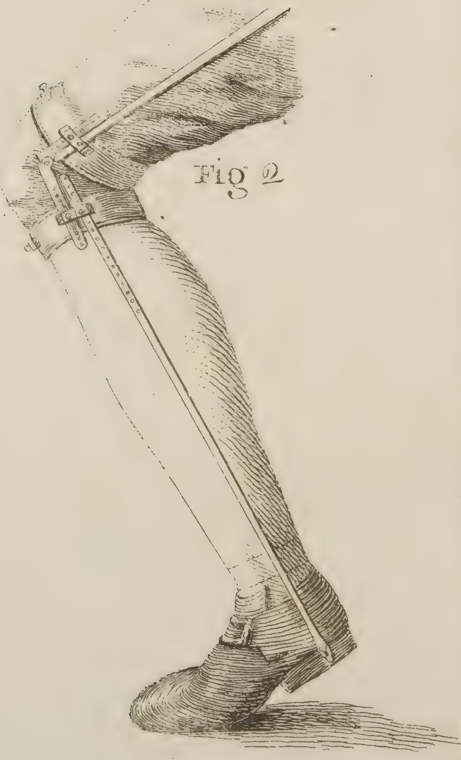


Fig 6

Fig 7

Fig 8

Fig 9

FIG. 9.

REPRESENTS one of the circulars at the knee in a ſide view,—with two double,and one ſingle iron ſcrew-plate, riveted to its external ſurface; alſo the ſtud on one end, which fixes it about the limb, by paſſing through a correſponding hole in the other end.

Of extracting TEETH.

THE extraction of teeth in many caſes, and for many reaſons, is an operation not only expedient but neceſſary: Among the various inſtruments recommended for performing it, the *key-inſtrument* is generally prefered. This inſtrument, notwithſtanding, is far from being complete, or faultleſs; I ſhall here only take notice of two of its defects, which are very capital.

1. THE *very oblique, or bad direction in which it draws, or acts, viz.* at an angle very ſeldom leſs, ſometimes greater than a right one, with reſpect to a perpendicular line paſſing through

the *axis* of the tooth (Plate VI. Fig. 2.). The moſt natural direction in which teeth can be drawn, ſeems to be the perpendicular one, or ſtraight upwards. Teeth with divergent, crooked and long fangs, or which have contracted oſſeous adheſions with their ſockets, (beſide other circumſtances,)—render the the drawing of them in this direction extremely difficult or impracticable: however, wherever it can be performed, it ſeems juſtly to claim the preference to every other direction; particularly to that in which the common inſtrument draws, which is nearly the worſt poſſible. Suppoſing it were the operator's wiſh and intention, either to break the ſockets or the teeth; ſcarcely could he find, perhaps invent, an implement better calculated to fulfil his purpoſe, the blackſmith's pincers not excepted. By experiment it has been found, five times in ſix, to break the ſockets even of teeth previouſly extracted, and looſely replaced; and ſometimes to break the teeth themſelves*.

2. Its *bruiſing effects on the gum.* The heel of the key-inſtrument has been variouſly modeled and protracted, with a view to leſſen the obliquity of its action;—while little or no advantage is gained by this device, with reſpect to direction, its bruiſing effects on the gum ſeem by it rather to be increaſed. In whatever way the heel may be faſhioned, theſe effects are, and will be, very conſiderable; for it acts on the gum with the ſame (according to ſome, with twice the) force which the inſtrument exerts on the tooth; and

---

* In the Britiſh, and from that tranſcribed into the Scots Magazine for January 1763, there is a very ſenſible paper on this ſubject; where an inſtrument, and the *modus operandi* for drawing the teeth perpendicularly, are deſcribed.

that on a very ſmall portion of it, and in the moſt unfavourable way. For the heel of this inſtrument, eſpecially when protracted, may be regarded as a centre and *fulcrum* about which the claw moves, and on which the inſtrument reſts while operating: and although the ſide or flat part of the heel be paralel with the ſurface of the gum, when the inſtrument is firſt applied or fixed; the very moment it begins to act, the whole heel, its inferior part or angle excepted, muſt recede from the gum: a circumſtance which, according to the form of the heel, throws the whole preſſure upon a point or a line*; by which the gum, previouſly much inflamed, is intolerably bruiſed; and this joined with the fracturing of the ſocket, very well account for the moſt exquiſite pain ſo univerſally complained of.

---

* A ſphere can only touch a plane in one point, and a cylinder can only touch it in a line.

Those who adviſe the extracting of the teeth in a perpendicular direction, allow that it is often neceſſary, the more effectually to diſengage them from their ſockets, to carry them a little to one ſide; and that the extraction in all caſes is much facilitated by this practice*: it may be then concluded, that the moſt ſucceſsful and favorable direction for drawing teeth, is one not altogether perpendicular, but at as ſmall an angle with it as poſſible, (Plate VI. Fig. 3. and 4. BE). An inſtrument conſtructed, ſo as to be capable to do this without bruiſing the gum, would ſeem tolerably complete.

---

* I would always adviſe, after the firſt effort in the ſtraight direction, to twiſt the tooth a little outwards, for it greatly facilitates the extraction in all caſes; and unleſs it be begun too ſoon, or carried too far, never hurts the ſocket, &c.——Brit. Mag. loco citat.

EXPLANATION of PLATE V.

FIG. 1.

REPRESENTS an inſtrument for drawing teeth, of a *new conſtruction*; which repeated trials on the dead and living ſubject, ſhow to be, among others, poſſeſſed of the qualities laſt mentioned. It may juſtly enough be regarded as the key-inſtrument, with ſome variation of form, lodged in a *caſe*.

BY turning the handle HH, the claw and part G are only moved; which therefore may be called the *handle of the claw*. By turning the handle C, the *canula* ABA and heel DD, or what I call the *caſe*, are only moved; this, therefore may be named the *handle of the caſe*. The handle of the claw introduced into the *canula* of the caſe, conſtitute the *common handle* KABa. To prevent this inſtrument, when employed to draw the teeth inwards, from hurting or preſſing on the fore-teeth,—the common handle joins the heel at an angle ſome degrees greater than a right one, as expreſſed by the doted line.

FIG. 2.

REPRESENTS the part of our inſtrument, which reſembles the key-inſtrument. The claw is here conſiderably raiſed above the *axis* of the handle; whereas it is generally placed below it in the common inſtrument. The claw is ſecured by a ſcrew-nail to the part G, through which there is a ſquare hole to receive the extremity of the handle, which is likewiſe ſquare; by which means this handle turns the claw independent of the caſe, which is here marked out by the pricked lines.

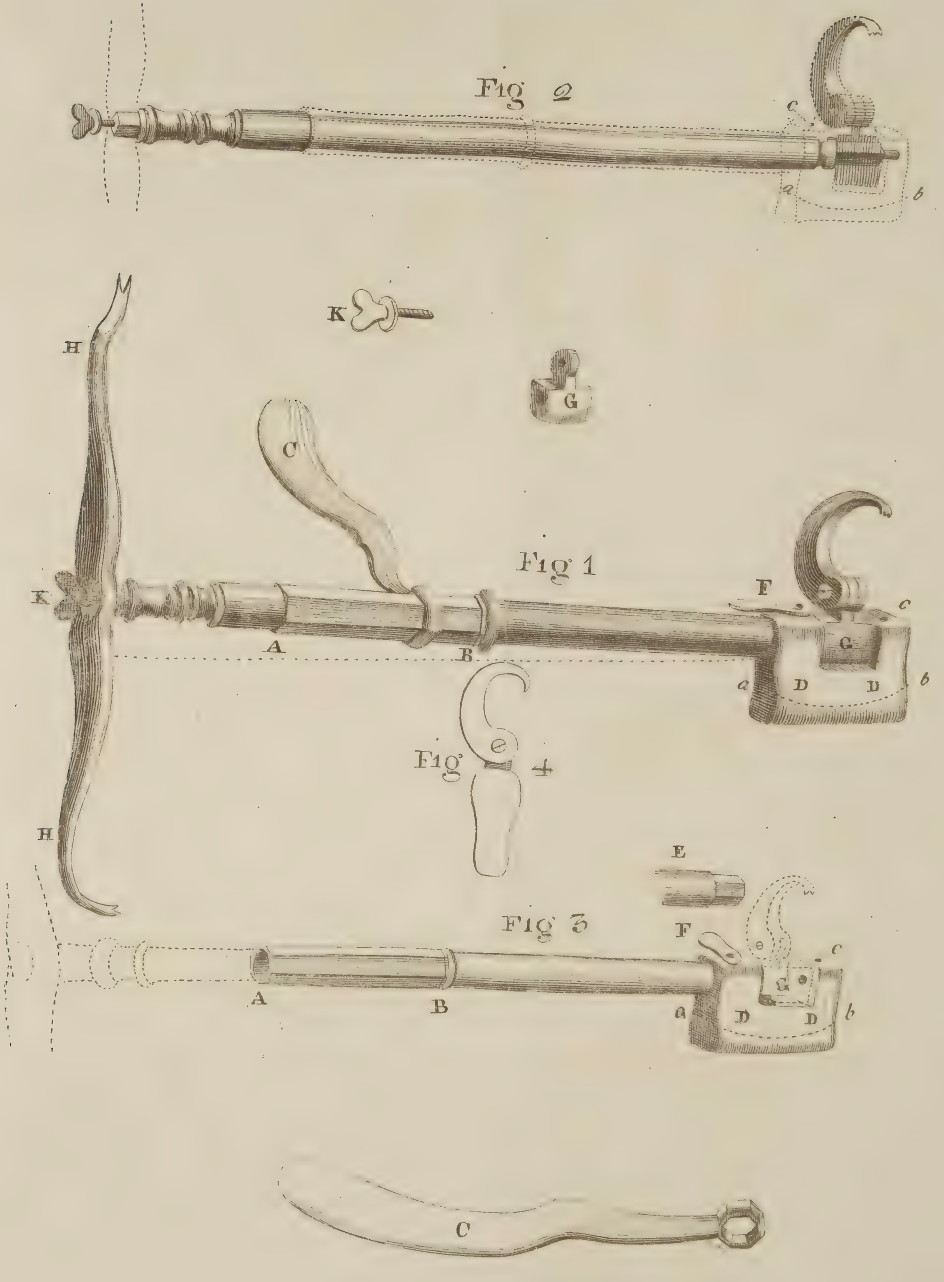
FIG. 3.

REPRESENTS the caſe by itſelf: the doted lines ſhow how the key-inſtrument (as repreſented in Fig. 2.) is received or lodged in the caſe: the handle of the caſe C is provided with an octagonal hole of ſuch ſize, as eaſily to receive, and move backwards and forewards upon the octagonal portion AB, of the *canula* of the caſe, (as in Fig. 1. C). This circumſtance prevents the handle from moving round, without carrying the whole caſe along in the ſame direction. There is a *reſt* or flat moveable piece of iron F, by which the caſe is as it were ſuſpended on the tooth or teeth next to the one to be extracted; and is thereby prevented in the act of drawing, from falling ſo low as to hurt the mouth when drawing inwards,—or the joining of the cheeks and lips with the gum, when drawing outwards. This *reſt* is made of ſuch a length as to cover more than one tooth; leſt the one immediately on either ſide of the tooth to be extracted, ſhould be wanting: it can occaſionally be fixed to the heel on the oppoſite ſide of the claw, where a hole *c* is provided for it; or there may be two *reſts* at the ſame time, as in Plate VI. Fig. 5. and 6. Although I regard theſe reſts as very uſeful,—yet I have often operated with this inſtrument without them, with great ſatisfaction. The preſſure of the *reſts* on the neighbouring teeth, is very inconſiderable.

It ſurely is an abſurd, though common practice, to uſe an inſtrument of the ſame dimenſions on every patient, however different the ſize and ſhape of the jaw-bone and teeth may be. Therefore, that heels of proper and and proportional ſhapes and ſizes might occaſionally be fixed to the ſame handle;—the heel DD is removeable from the canula or other part of the caſe ABa; the part of the canula which enters the heel is ſhaped as at E; the ſame ſcrew-nail, which fixes the *reſt* to the heel, alſo paſſes through the part of the canula which is inſerted in the heel: and, by catching in a notch purpoſely made in the handle of the claw, as at c in Fig. 2.—it thus both fixes the two parts of the caſe together; and prevents the handle of the claw from falling out, or from being withdrawn, unleſs the nail is previouſly turned. When the *molares* of the upper jaw-bones are to be drawn inwards, the heel may be made of a roundiſh form, as marked by the pricked line a b ; and a little thicker than ordinary, to prevent the palatal proceſs of the maxillary bones from being injured by its preſſure. I have heard of a caſe, where, by the heel of the common inſtrument, this proceſs was broke,—and puſhed up into the noſe.

THE ſame obſervation may be made with reſpect to the ſize of the claw. It would evidently be prepoſterous to uſe one of the ſame ſize indiſcriminately to draw ſmall and large teeth, *e. g.* the *inciſores* and the *molares*. The claw for this inſtrument deſcribes a greater ſection of a circle, and is more turned in at the point than that of the common inſtrument; it is alſo pretty ſharp at the point, to lay firm hold of the tooth: for, as this inſtrument draws in a direction much more perpendicular than the common

PLATE.V



common inſtrument, it is otherways apt to ſlip over the tooth. Fig. 4. gives a profile view of the claw and heel of this inſtrument.

Explanation of PLATE VI.

FIG. I.

REPRESENTS the manner of holding, applying and operating with this inſtrument. It is ſuppoſed to be fixed on one of the *molares* of the right ſide of the lower jaw-bone; (Fig. 3. ſhews how the claw fixes on the tooth): the left hand manages the handle of the caſe c, ſo as to preſerve the flat ſide of the heel (which is here repreſented as covered with ſoft rag) conſtantly and accurately parallel with the ſurface of the gum; the fore finger of the ſame hand reaches forward to preſs upon the claw: the handle of the claw H is held by the left hand, the fore-finger of which is ſtretched along the inſtrument. The tooth is extracted or elevated with ſurpriſing facility from its ſocket, in an almoſt perpendicular didirection (Fig. IV. B E)—by turning the right hand with the handle of the claw H, a very little from right to left. The *molares* of the oppoſite ſide are extracted in the ſame manner,—by only reverſing the claw, and changing hands.

The part of the heel of this inſtrument DD is a little hollowed, to lodge the prominent part of the gum; that the preſſure, when the heel is properly managed, may be equally divided over every part of the gum covered by the heel: the conſequence is, that the patient feels very little pain from the heel, or the gum is not in the ſmalleſt degree bruiſed.

The part G, or heel of the claw, is ſunk about a twelfth part of an inch below the ſurface of the heel of the caſe DD. It is of ſufficient breadth to receive any of the *molares*; ſo that the tooth, on which the claw is fixed, is only allowed to deviate from the perpendicular about the twelfth part of an inch (Fig. 4. A B): a ſpace hardly ſufficient to diſengage the fangs from the ſocket, and to facilitate the extraction; while it is not ſo great as to endanger the burſting of the ſocket.

It will now be underſtood, that this inſtrument applies, with equal propriety, eaſe, and ſafety,—to extract the teeth of either jaw-bones, inwards or outwards; whether the *molares*, *cani-*

ni, or *inciſores*. When the *canini* or *inciſores* are to be extracted outwards, the heel of the caſe muſt be made concave (as in Plate VI. Fig. 6.); to apply equally and eaſily to the convexity of the jaw-bone: when they are to be extracted inwards, the ſide of the heel which applies to the gum is to be convex (as in Fig. 5.), for the ſame reaſon for which it was in the other caſe concave.

The ſtructure of our inſtrument is evidently more complex than that of the common inſtrument; but this circumſtance can afford no reaſonable objection againſt it, if the great advantages, mentioned above, are obtained in conſequence, viz. the bruiſing of the gum always avoided,—and the burſting of the ſocket prevented, wherever it is poſſible to be prevented; while the tooth is elevated from its ſocket, et, in an almoſt perpendicular direction, with as little pain as is conſiſtent with the extraction of a tooth.

I SAID above, that the burſting of the ſocket was prevented by the uſe of this inſtrument, wherever it was poſſible to be prevented; for Surgeons, of the greateſt experience in this branch, confeſs, in many caſes, this accident is not to be avoided,—by any dexterity, device or artifice whatever*: all I contend for, is, that, by operating with this inſtrument, as above taught, this diſagreeable, painful, and ſometimes dangerous accident, is, in many caſes, avoidable, where it inevitably happens from the uſe of the common inſtrument.

---

* It often happens, that there are very ſtrong oſſeous adhaeſions between a tooth and its ſockets; and it happens as frequently, that the roots go off in various directions; which render it impoſſible to draw the tooth without breaking ſome of theſe, or the edge of the ſocket.——*Brit. Mag. loc. citat.*

See M. Fouchard's *Chirurgien dentiſte*, Tom. II. Pages 210, 211, 212.

As the handles of the claw and of the caſe (Plate V. Fig. I. HH, and C) are both removeable at pleaſure from this inſtrument, it becomes in conſequence abundantly portable; — the handle of the caſe is thin at one end; to ſerve for a ſcrew-key to turn the nails of the claw and heel, when neceſſary: the handle HH is here purpoſely made of ſteel; with one extremity it acts, in extracting ſtumps, as a punch and lever,—with the other, as a hook or a lever of another form.

In Plate VI. Fig. 7. I have repreſented the crows-bill *forceps* ſomewhat different, in the ſhape of its points, from that commonly uſed: they are bended

PLATE VI

Fig. 7

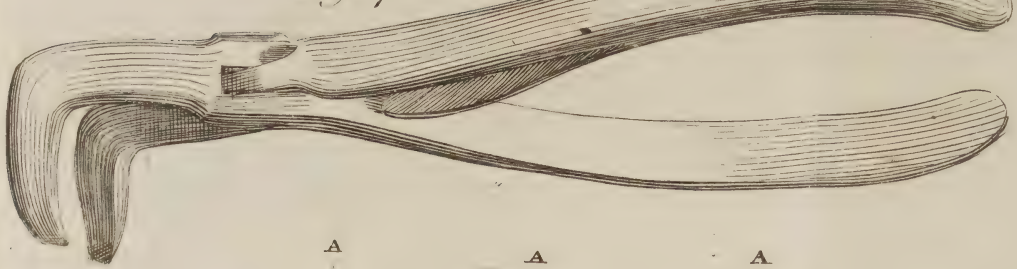


Fig. 2

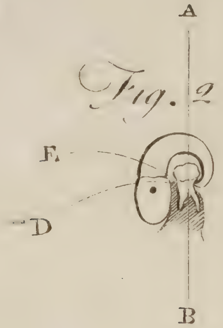


Fig. 3

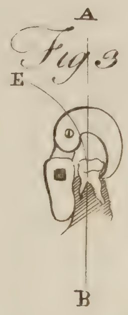


Fig. 4

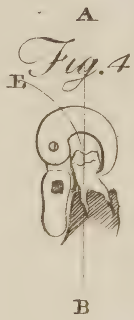


Fig. 5

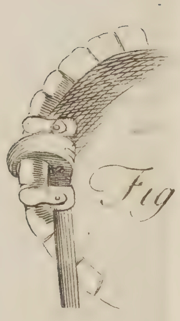


Fig. 1

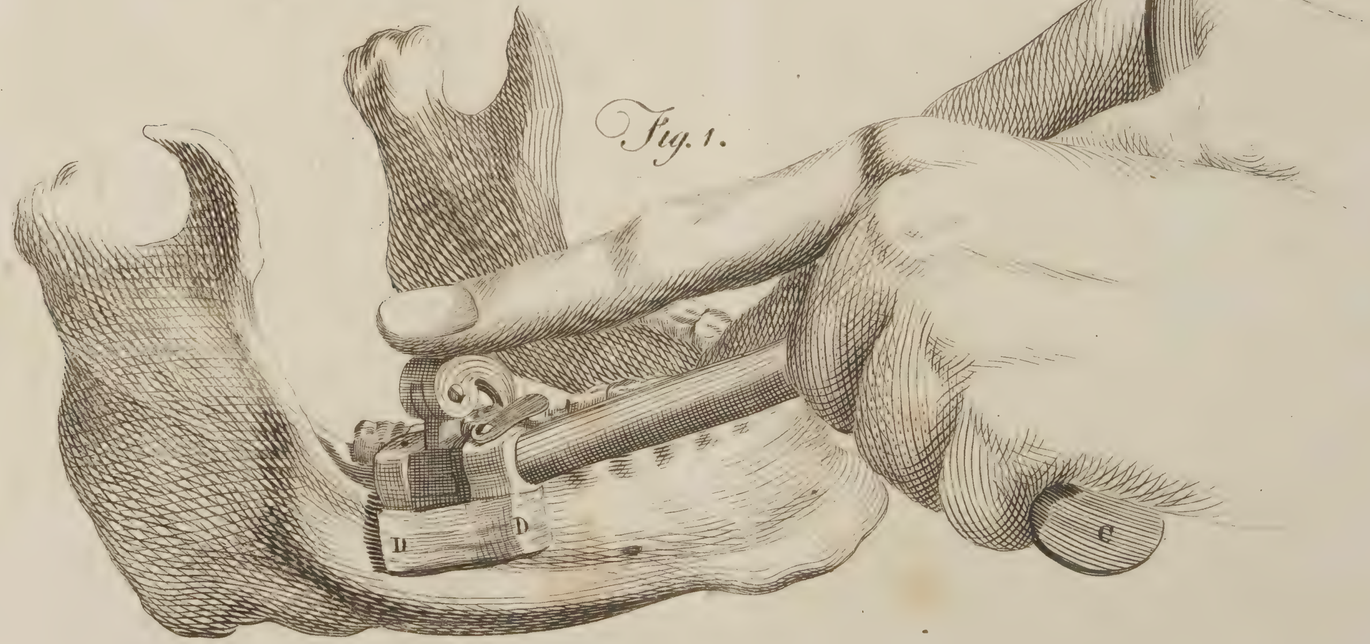
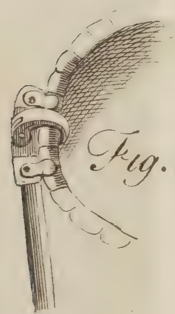


Fig. 6



bended to a leſs angle, and are thinner at their extremities; the more readily and ſecurely to lay hold of a tooth, or of a ſtump, even ſuppoſing them below the ſurface of the gum.

If my deſcriptions, whether of this inſtument, or the machines mentioned formerly,—may ſeem to any, imperfect, inaccurate, or unintelligible, (which, I fear much, will indeed be the caſe); they may be furniſhed with the originals, from the ingenious artiſt* I employ.

---

* Mr. Boog, an Inſtrument-maker in this city.

FINIS.

ERRATA.

Page 45. line 6. *For* humurus *read* humerus
53. 4. *Cancel* compound
116. 9. *For* ſteel-ſplints DDD, *read* ſteel ſplints EEE.

Nota, The readers will eaſily correct, in the peruſal, any other typographical inaccuracies which may occur.

DIRECTIONS for placing the plates.

Plate I. To front	page 106.
II.	156
III.	
IV.	194
V.	206
VI.	212